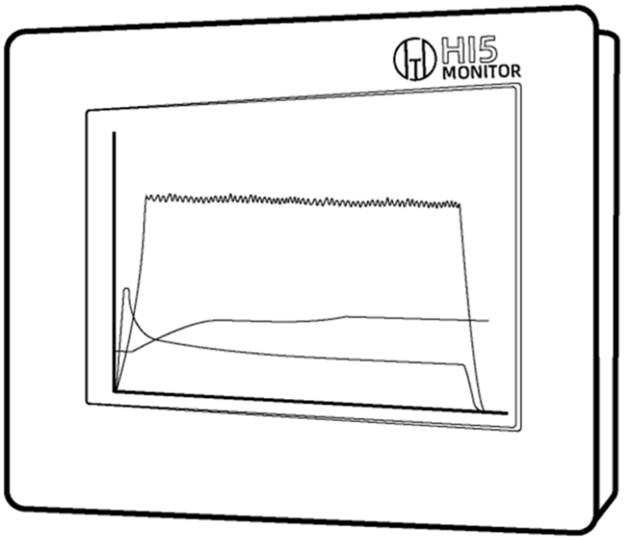
User Manual

Technical User Manual

Product Model

Hi5 Weld Monitor

May 26
Version 700292-1



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Document Revisions

Date	Version Number	Approved By	Document Changes
Feb 19, 2026	700292-0	Sean Simmons	Initial release of the Hi5 Technical User Manual
May 22, 2026	700292-1	Sean Simmons	Add verified Incremental Encoder Displacement Sensor. Improve wording of calibration instructions

Languages

This document is only published in the English language.

Table of Contents

1 BACKGROUND

Description of the User

This manual has been written to inform custom equipment manufacturers, integrators, control engineers, weld engineers, and/or maintenance technicians how to safely install, setup, operate, and maintain the weld monitor.

This manual has been written for the Hi5 Weld Monitor that is a data collection and monitoring device. The manual applies to the V1.1.00 version of firmware.

This document should be carefully read before installing and operating the weld control. Failure to follow the instructions defined in this manual could create a safety hazard or impact the warranty on the product.

1.1 Conventions Used in This Manual

The following style conventions are used in this document:

Bold Italics type font is used for emphasis

- Bulleted lists generic lists and do not define a sequence or procedures

1) Numerical lists define a sequence or procedures

`Courier` text is used for system output, such as an error message or script URLs, complete paths, filenames, prompts, and syntax

1.2 Explanation of Symbols

This section defines the symbols used throughout this document.

DANGER!

DANGER!
Danger indicates a hazard with a high level of risk which, if not avoided, will result in immediate, serious personal injury or loss of life. Examples are: exposed high voltage; exposed fan blades.

WARNING!

WARNING!
The Warning symbol indicates a hazard with a potential hazard which ***could result*** in personal injury or loss of life. Examples are: not using proper personal protect; removal of guards.

CAUTION!

CAUTION!
The Caution symbol indicates a hazard which ***could result*** in non-life threating personal injury or damage to equipment. CAUTION may also be used to alert against unsafe practices.

ESD Susceptibility
The ESD Susceptibility symbol indicates that handling or use of this item by result in damage from ESD if proper precautions are not taken. Non-compliance with these recommendations may result in damage to the control, welding machine or workpiece and voiding of the warranty.

NOTICE

NOTICE
The Notice symbol is used for making recommendations on use or supplementary information. Non-compliance with these recommendations may result in damage to the control, welding machine or workpiece and voiding of the warranty.

HELPFUL TIP
The Helpful Hint symbol is used to provide additional information on a topic that may be helpful to the user.

1.3 Important Safety Instructions

Before installing, starting up, or operating the Hi5 Weld Monitor, carefully read all safety instructions to ensure safe use of the product.

SAVE THESE INSTRUCTIONS

The safety instructions are part of the product. Keep the instructions in a safe and easily accessible place near the product.

DANGER!	Always disconnect power before servicing or establishing electrical connections with the product.
DANGER!	Use product only as described in this manual.
WARNING!	Stop Operation if any problems occur. If the equipment is not working as it should, has been dropped, damaged, left outdoors, or has been in contact with water, contact ENTRON or Heron.
DANGER!	Upon receipt of unit, inspect unit for damage from shipping. Before applying power to product, inspection electrical connections are secure.
DANGER!	Keep free of dust and debris.
DANGER!	Do not install the product in any of the following environments: damp environments where humidity is 75% or higher; environments near a high-frequency noise source; hot environments where temperatures are above 45° C; cold environments where temperatures are below -10° C;

1.4 Technical Support

1.4.1 Internet

The latest version of the documentation and other helpful resources in the ENTRON Document Library page found in the Resource section of the ENTRON website: https://www.entroncontrols.com

1.4.2 Documentation Request

Documentation, user instructions and technical information can be requested by emailing ENTRON Controls at customerservice@entroncontrols.com

Please include your name and email

1.4.3 Service and Technical Support

For service and technical support, we request that customers fill out the Technical Support Form found on our website at link below:

NOTICE

TECHNICAL SUPPORT FORM LINK

https://www.entroncontrols.com/resources/technical-support.html

After the web form has been completed, your case will be assigned to one of our technical specialists who will contact you directly.

For all other questions, our customer service team is available to assist. The contact information for each our manufacturing and service sites is shown in the table below. Please contact the site for your specific region.

Manufacturing Site	Country	Phone	Email	Regions Supported
ENTRON Controls, LLC	USA	+1-864-416-0190	tech.support@entroncontrols.com	USA, Canada
Heron Intelligent Equipment Co., Ltd.	China	+86-20-878-13325	info@heronwelder.com	Rest of World

2 INTRODUCTION

2.1 Weld Monitor

The Hi5 Weld Monitor is process monitoring device that collects data during the welding process. The monitor collects data from each millisecond of the weld process. This data can be used to:

1) Review the weld data to optimize the weld schedule defined in the weld control
2) Identify and alert the user of a weld that does not meet the set parameters (i.e. a bad weld)
3) Compare the curves of up to 10 welds to analyze process repeatability
4) Identify mechanical issues in the machine such as a failing electrode or actuator
5) Record each weld with data tagging to the weld schedule and work piece for traceability
6) Export the data to an external device for analysis

The Hi5 Weld Monitor measures five key welding signals. The Hi5 Weld Monitor includes sensors to measure current, voltage, and resistance. Sensors for Force and Displacement are sold separately.

1) Current
2) Voltage
3) Resistance
4) Force
5) Displacement

2.2 Features

The Hi5 Weld Monitor is designed with a high sampling rate to provide high resolution monitoring of the welding process.

The primary features are:

- Current, voltage, displacement, and force signals are sampled at speeds up to 100 K/S.
- Supports five levels of current measurements: 6KA, 20KA, 60KA, 200KA and 1000KA.
- Supports two levels of voltage measurements: 20V and 60V.
- Supports three distinct units for measuring force: KN, KGF, LBF. Where each unit supports four levels of force measurements (2kN, 10kN, 50kN, 200kN).
- Current measurement accuracy can reach 0.01KA.
- Displacement measurement accuracy can reach 0.005mm.
- Support the storage of 10 million points of welding data, using a database to save the characteristics of the measured data. This is convenient for users to access and export weld data for full traceability.
- Use text mode to save the measured curve data and program parameters, which is convenient for transferring settings to additional devices.
- Weld profiles are presented to the user in a graphical format, and a wealth of operations are available to the user to analyze the quality of the weld using the touch screen interface
- Multi-user privilege settings to ensure user data security and prevent accidental deletion and modification.
- Multiple Languages supported: English and Chinese

- Supports Modbus and HTTP communication protocol.
- Displacement sensors support both analog and encoder sensors.
- Supports measurement of capacitor discharge, medium, and utility frequencies.
- Supports two measurement modes: program number mode and workpiece cycle mode.
- 1,000 distinct weld monitoring programs and 30 distinct workpiece cycles.
- Work cycle mode supports up to 50 spot welds.
- Supports alarm function for when a certain parameter exceeds the preset limit
- The maximum weld time is 2 seconds when in Current Trigger Mode
- The maximum weld time is 5 seconds when in Force Trigger Mode

2.3 Product Specifications

Specification	Value
Operating Voltage	24V
Power	24V DC
Maximum sampling frequency	100 KHz
Sampling accuracy	16 bit
Screen size	10.4"
Operating temperature	-10°C to +45°C
Operating humidity	≤75%
Data storage	> 8GB

2.3.1 Dimensions

The Hi5 Weld Monitor is designed in a compact format with a large screen for the data to be easily visible to the machine operator. The touch screen is enclosed in a rigid steel frame. The unit can be mounted to a weld control cabinet, swing arm monitor mount or a stand-alone cabinet. The dimensions of the Hi5 Weld Monitor are shown in Figure 1 and Figure 2.

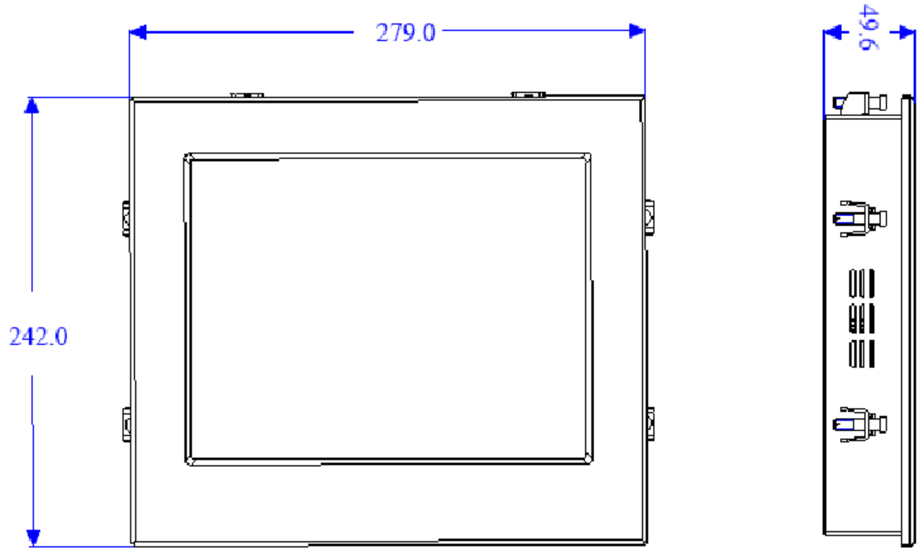


Figure 1: Hi5 Weld Monitor Front and Side Dimensions in Millimeters

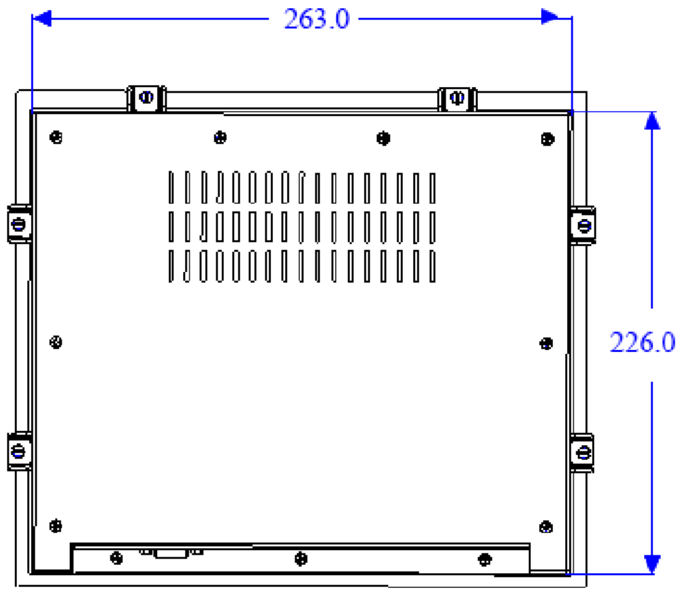


Figure 2: Hi5 Weld Monitor Back View Dimensions in Millimeters

2.3.2 Wiring Diagram

The wiring diagram for the Hi5 Monitor is shown in Figure 3. The user connections of the Hi5 Weld Monitor are shown in Figure 4.

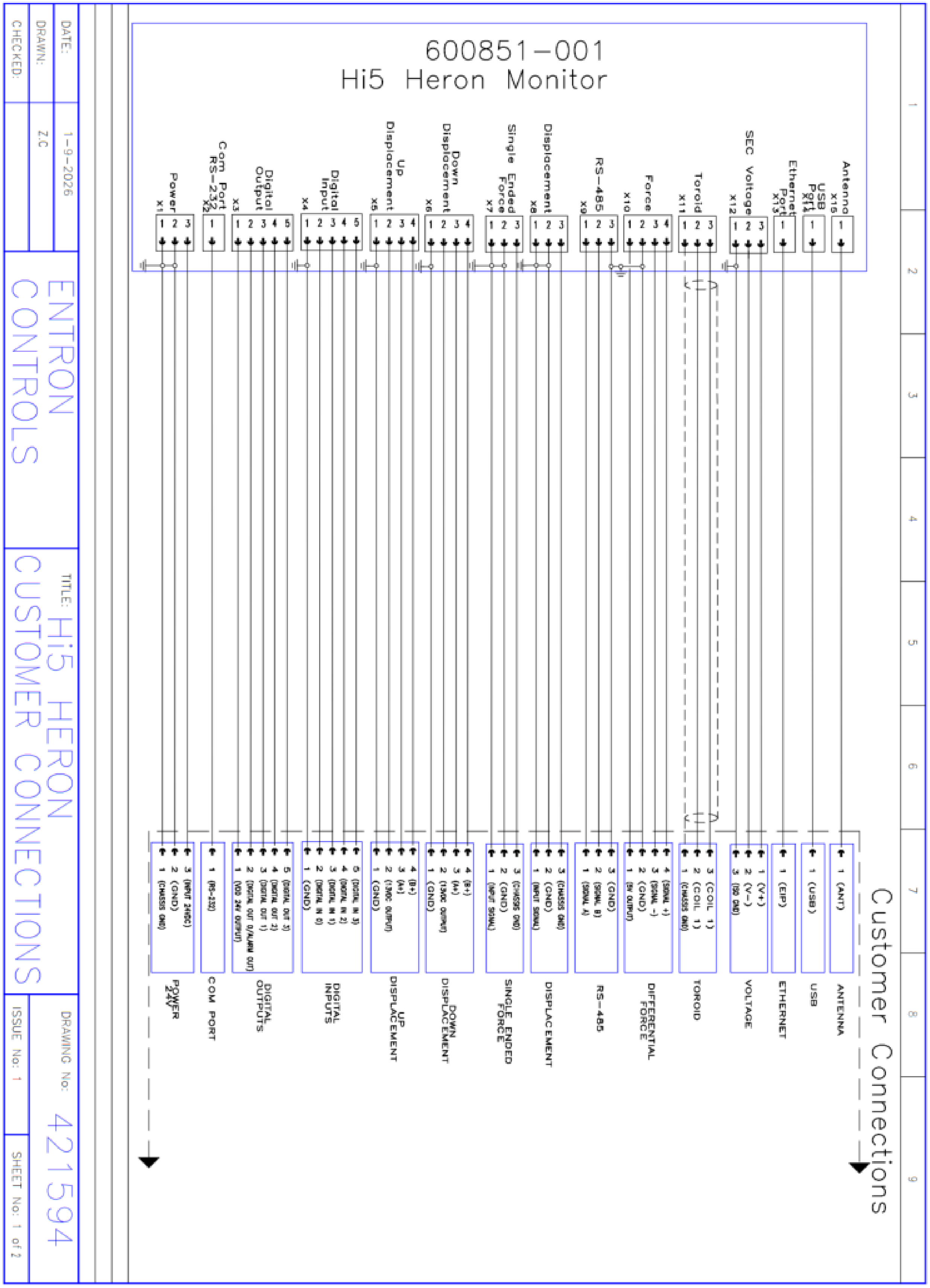


Figure 3: 421594 Hi5 Weld Monitor Wiring Diagram

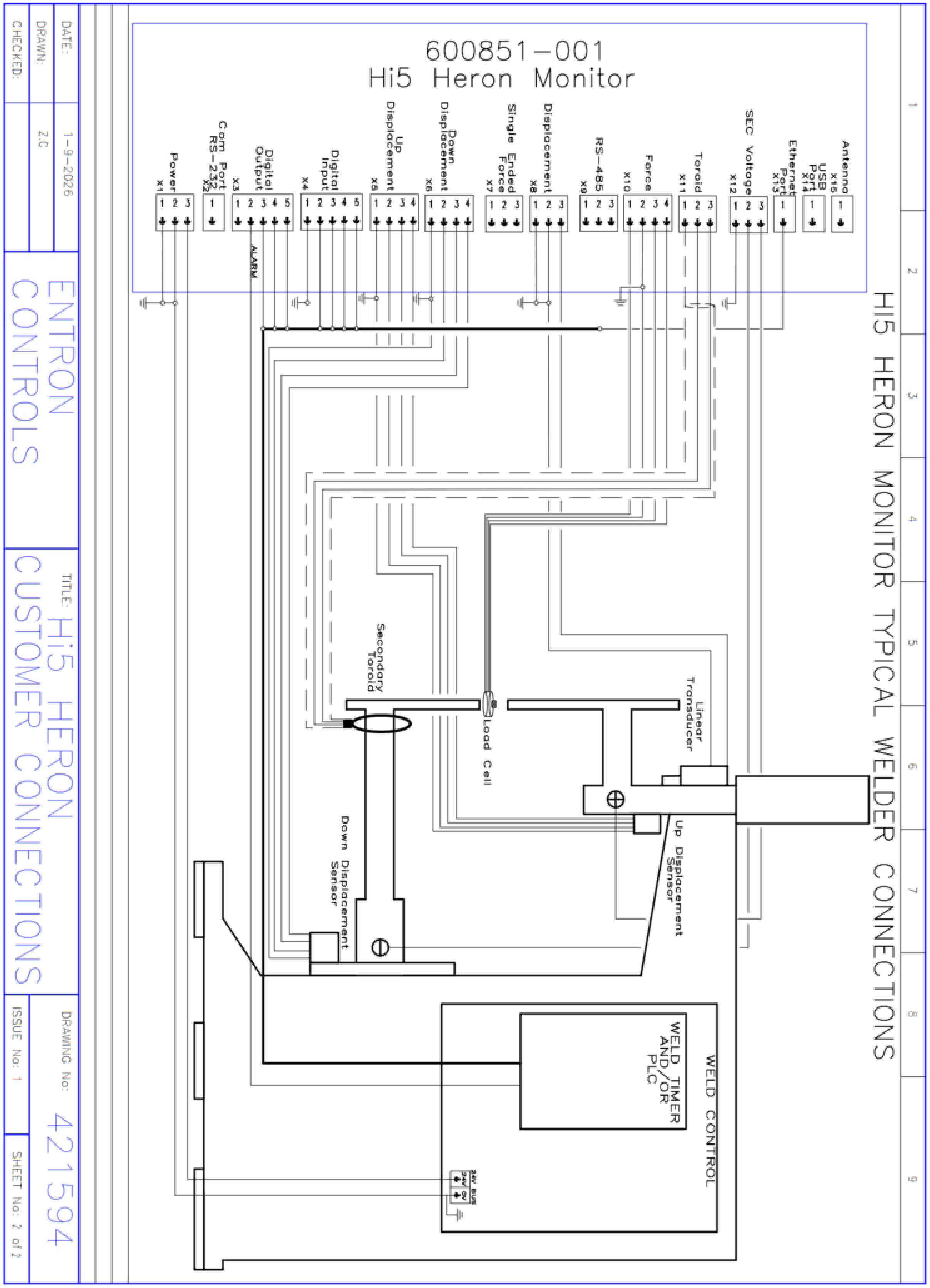


Figure 4: 421594 Hi5 Customer Connections

2.3.2.1 Power Connection

The power connections are defined on terminal X1 as shown in Table 1.

Item	Terminal Label	Pin	Description
Power	X1	1	Earth PE
		2	GND (0 VDC)
		3	24V DC +/-2V

Table 1: Power Connection X1

2.3.2.2 RS232 Serial Communication Connection

The RS232 (DB9) serial communication connections are defined on terminal X2 as shown in Table 2.

Item	Terminal Label	Pin	Description
RS232 Communication	X2	3	Pin 3 is the transmit connection for the RS232 Connection
		4	Pin 4 is the receive connection for the RS232 Connection
		5 & 9	Pin 5 and 9 are the 24V power pins that are internally connected. The output driving capability is up to 500mA.
		1 & 6	Pin 1 and 6 are Ground (0V/GND) connections for the RS232 Connection

Table 2: RS232 Serial Communication Connection X2

2.3.2.3 Digital Output Connection

The Digital Output connections are at terminal X3. The output signal is 24V. The single IO output drive capacity is 500mA. Table 3 defines the connection points. The Digital Outputs are typically used to notify an external system such as a PLC or light that an alarm condition is present.

Item	Terminal Label	Designator	Pin	Description
Digital Outputs	X3	VDD	1	24V output from the Digital Outputs
		Alarm	2	The 24V output with maximum current of 500mA for alarm signals

		DO-1	3	The IO1 output for digital outputs with a drive capacity of 500mA. **Reserved future use.**
		DO-2	4	The IO2 output for digital outputs with a drive capacity of 500mA. **Reserved future use.**
		DO-3	5	The IO3 output for digital outputs with a drive capacity of 500mA. **Reserved future use.**

Table 3: Digital Output Connection X3

2.3.2.4 Digital Input Connection

The Digital Input connections are defined on terminal X4 as shown in Table 4. **This connection is reserved for future use and not currently active**.

Item	Terminal Label	Designator	Pin	Description
Digital Inputs	X4	0V/GND	1	The Digital Inputs and Outputs ground connection **Reserved future use.**
		DI-0	2	The IO0 digital input **Reserved future use.**
		DI-1	3	The IO1 digital input **Reserved future use.**
		DI-2	4	The IO2 digital input **Reserved future use.**
		DI-3	5	The IO3 digital input **Reserved future use.**

Table 4: Digital Input Connection X4

2.3.2.5 Displacement Encoder Connections

The Hi5 Monitor has the capability to measure two displacement signals from an optical or linear encoder sensor. The displacement of the upper electrode and lower electrode on the machine can be measured independently. The displacement sensors require 13VDC supply voltage. The connections for the Upper Displacement Encoder are shown in Table 5.

Item	Terminal Label	Designator	Pin	Description
Upper Displacement Encoder	X5	0V/GND	1	The ground connection
		DC13V	2	The 13V DC supply voltage output for the encoder with a maximum current of 500mA
		Up-Disp-A+	3	The encoder A+ signal for the upper displacement signal
		Up-Disp-B+	4	The encoder B+ signal for the upper displacement signal

Table 5: Upper Displacement Encoder Connection X5

The connections for the Lower Displacement Encoder are shown in Table 6.

Item	Terminal Label	Designator	Pin	Description
Lower Displacement Encoder	X6	0V/GND	1	The ground connection
		DC13V	2	The 13V DC supply voltage output for the encoder with a maximum current of 500mA
		Down-Disp-A+	3	The encoder A+ signal for the lower displacement signal
		Down-Disp-B+	4	The encoder B+ signal for the lower displacement signal

Table 6: Lower Displacement Encoder Connection X6

2.3.2.6 Force Connection

The Hi5 Monitor can measure the electrode force via an analog input. The connections for the force sensor are defined on terminal X7 as shown in Table 7.

Item	Terminal Label	Designator	Pin	Description
Force Analog Input	X7	Force	1	The analog input from the pressure sensor be from -10V to 10V
		0V/GND	2	The ground connection
		PE	3	The protective earth (PE) connection used for shielded cable. Customers are encouraged to use shielded cable to avoid noise interference.

Table 7: Pressure Analog Input X7

2.3.2.7 *Displacement Analog Connection*

The Hi5 Monitor can also measure displacement via an analog input. The connections for an analog displacement sensor are defined on terminal X8 as shown in Table 8.

Item	Terminal Label	Designator	Pin	Description
Displacement Analog Input	X8	Displacement	1	The analog input from the displacement sensor with a range from -10V to 10V
		0V/GND	2	The ground connection
		PE	3	The protective earth (PE) connection used for shielded cable. Customers are encouraged to use shielded cable to avoid noise interference.

Table 8: Displacement Analog Connection X8

2.3.2.8 *RS485 Serial Communication Connection*

The RS485 serial communication connections are defined on terminal X9 as shown in Table 9.

Item	Terminal Label	Pin	Description
RS485 Communication	X9	RS-485-A	The A connection for RS485
		RS-485-B	The B connection for RS485
		0V/GND	The ground connection for the RS485

Table 9: RS485 Communication Connection x9

2.3.2.9 *Force Differential Connection*

The Hi5 Monitor can measure force using a differential force sensor. The connection requires 5V DC. The connections are defined on terminal X10 as shown in Table 10.

Item	Terminal Label	Designator	Pin	Description
Force Differential Sensor Input	X10	5V	1	The 5V DC output supply voltage connection with a maximum current of 500mA
		0V/GND	2	The ground connection
		P-	3	The negative force input
		P+	4	The positive force input

Table 10: Force Differential Connection X10

2.3.2.10 Current Sensor Connection

The Hi5 Monitor can measure the secondary weld current using a toroid sensor. The connections for a current sensor are defined on terminal X11 as shown in Table 11.

Item	Terminal Label	Designator	Pin	Description
Current Analog Input	X11	PE	1	The protective earth (PE) connection used for shielded cable. Customers are encouraged to use shielded cable to avoid noise interference.
		Coil 1-1	2	Connection 1 from current sensor
		Coil 1-2	3	Connection 2 from current sensor

Table 11: Current Sensor Connection X11

2.3.2.11 Voltage Sensor Connection

The Hi5 Monitor can measure the voltage across the secondary via the voltage cable. The voltage leads should be placed as close to the electrodes as possible for your machine. The connections for the voltage signals are defined on terminal X12 as shown in Table 12.

Item	Terminal Label	Designator	Pin	Description
Voltage Input	X12	ISO GND	1	The ground connection specifically for voltage sensor
		Sec. U-	2	The negative voltage connection [0-10V] AC/DC
		Sec. U+	3	The positive voltage connection [0-10V] AC/DC

Table 12: Voltage Sensor Connection X12

2.3.2.12 Ethernet Connection

The Hi5 Monitor has an ethernet connection for communication with external devices. The ethernet port is defined as terminal X13 on board. The Ethernet is an RJ45 port and operates at 100 Mbps.

2.3.2.13 USB Connection

The Hi5 Monitor has an USB2.0 connection for exporting data to external devices. The USB port is defined as terminal X14 on board.

2.3.2.14 4G Antenna Connection

The Hi5 Monitor has the capability to communicate wireless via 4G antenna. **This connection is optional and needs to be specified at the time of order**. The 4G connection is defined as X15 on the board.

2.3.3 Force Sensors

The Hi5 Monitor is designed to work with differential type and single-ended output sensors. The differential output force sensor, commonly referred to a load cell, has a positive and negative output. The single-ended output force sensor is commonly referred to as an analog force sensor.

The force sensor selected must be compatible with the forces for your welding application and dimensionally fit the machine. It is the customer's responsibility to select the Force Sensor that fits the application and machine design. To assist customers with sensor selection, the specification of verified sensors are defined below.

2.3.3.1 Force Sensor with Differential Outputs

Verified Force Sensors with differential outputs are defined in Table 13.

Force Sensor Type	Hi5 Connection	Input Voltage	Verified Sensors			
			Brand	Part Number	Range	Note
Force Sensor with Differential Output	X10	5V(1)	Baumer	DLM30-BU.502.CP3.C4	5 kN	(1) The Baumer sensors can connect to an amplifier (e.g., Baumer DAB10-AU) in order to change the differential output signal to single-ended output signal, so that the sensors can connect to the X7 interface on the Hi5 Monitor.
			Baumer	DLM40-BU.203.CP3.C4	20 kN	
(1) Via X10 Interface						

Table 13: Verified Differential Force Sensors

NOTICE

For use of the Hi5 Monitor on a robotic weld gun, a strain sensor can be used to measure the weld forces. The Baumer DST20-A102P is a verified sensor.

2.3.3.2 Force Sensors with Single-Ended Output (Analog)

Verified Force Sensors with singled-ended outputs (i.e. Analog) are defined in Table 14.

Force Sensor Type	Hi5 Connection	Output Voltage	Input Voltage	Verified Sensors			
				Brand	**Part Number**	**Range**	**Note**
Force Sensor with Single-Ended Output	X7	-10V Min 10V Max	Sensors can choose the following power supplies from Hi5 Monitor • 5V (via X10 interface) • 13V (via X5 or X6 interface) • 24V (via X3 interface)	Baumer	DLRU-L003.14C.B410 TC	100 kN	This sensor supports cable length up to 10 m.

Table 14: Verified Force Sensors with Single-Ended Output

2.3.4 Displacement Sensors

The Hi5 Monitor is designed to work with encoder type and single-ended output (i.e. Analog) displacement sensors. Incremental Encoder type sensors have two output signals to the Hi5 monitor for measuring relative position changes. The Single-Ended Output Displacement sensor outputs a single voltage signal for measuring actual position.

NOTICE

When measuring both displacement of both the upper and lower electrode at the same time, at least one sensor must be a Incremental Encoder Displacement sensor, because the Hi5 Monitor only has one interface (X8) for the single-ended output displacement sensor.

The displacement sensor selected must be compatible with the weld stroke of your welding application and dimensionally fit the machine. It is the customer's responsibility to select the Displacement Sensor that fits the application and machine design. To assist customers with sensor selection, the specification of verified sensors are defined below.

2.3.4.1 *Incremental Encoder Displacement Sensor*

Verified Incremental Encoder Displacement Sensors are shown in Table **15**.

Displacement Sensor Type	Hi5 Connection	Output Voltage Low Level (V)		Output Voltage High Level (V)		Input Voltage (V)	Resolution (µm)	Output Type	Verified Sensors		
		Min	Max	Min	Max				Brand	Part Number	Resolution
Incremental Encoder	X5 or X6	0	2.5	8	19	13(1)	2.5, 5, 10, 25, or 50	PNP	Hopo	HB20-005-24-8-270-3-NC(2)	5 µm

(1) Via X5 or X6 interface.
(2) This sensor requires choosing 5 µm/pulse at SENSOR Page on Hi5 Monitor.

Table 15: Verified Incremental Encoder Type Displacement Sensor

2.3.4.2 *Single-Ended Output Displacement Sensor*

Verified Single-Ended Output Displacement Sensors are shown in Table 16.

Displacement Sensor Type	Hi5 Connection	Output Voltage	Input Voltage	Verified Sensors	
				Brand	Part Number
Displacement Sensor with Single-Ended Output	x8	-10V Min 10V Max	Sensors can choose the following power supplies from Hi5 Monitor • 5V (via X10 interface) • 13V (via X5 or X6 interface) • 24V (via X3 interface)	Balluff	BTL7-P-Series Analog Voltage

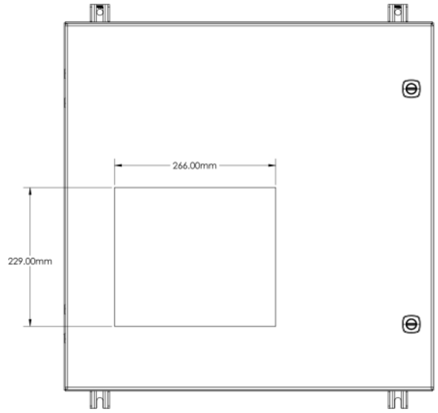
Table 16: Verified Singled-Ended Output Displacement Sensor

2.4 Installation

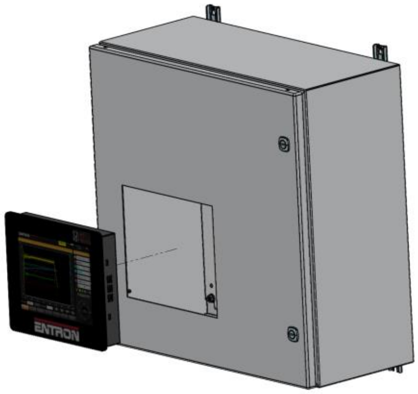
The installation of the Hi5 weld monitor should be performed by a trained electrician and all local safety protocols must be followed when installing the unit. These instructions should be carefully read before installation. Failure to adhere to these instructions may invalidate the warranty on the control

2.4.1 Panel Mount Hardware Installation

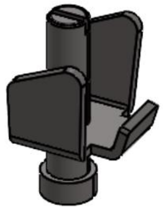
1. Inspection the package for damage
2. Verify all contents are in the package
    a. 6 x panel mount brackets
    b. 1 x toroid
    c. 1 x set voltage leads
    d. Hi5 Monitor
3. Cut a 226mm Wide x 229mm High cutout in the enclosure to mount the Hi5 Monitor
    a. The enclosure panel thickness cannot exceed 12mm



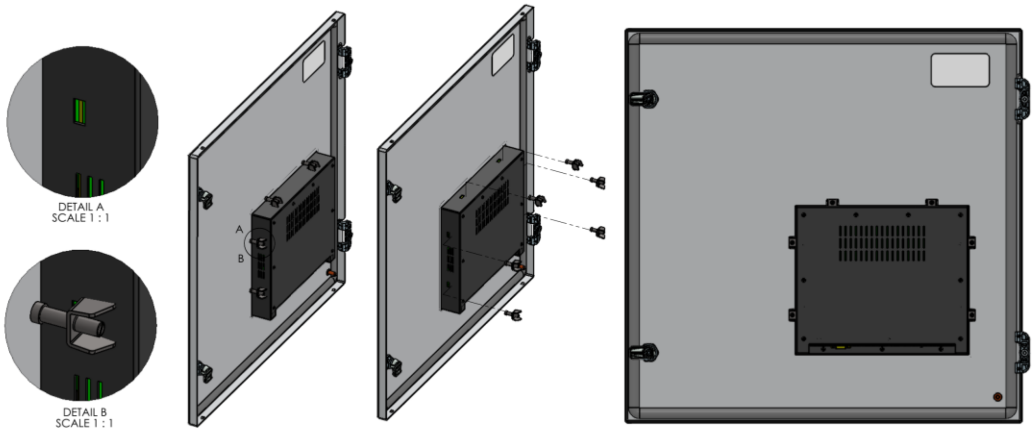
4. Insert the Hi5 Weld Monitor into the cutout



5. Use the 6x panel mount brackets provided to secure the Hi5 Weld Monitor from the back of the panel

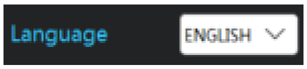


6. Put the hooks of the panel mount bracket into the cutouts on the Hi5 Weld Monitor and tighten the screw until it is firmly pressed and secure against the panel.



2.4.2 Installation Instructions

1) Inspection the package for damage.
2) Review the Wiring Diagram
   a. Check the External Wiring Diagram, before proceeding with set-up. The Wiring Diagram is shown in Figure 3. The detailed description of each connection point can be found in WIRING DIAGRAM Section.
3) Wire the desired connections and sensors to the Hi5 Monitor
4) Connect the 24V Power Supply to the Hi5 Monitor to turn ON the device
5) Configure the device language, current calculation, and curve output
   a. From the Measure page, tap **SYSTEM SETUP** on the footer menu
   b. Enter the default Supervisor Password of **369369**
   c. Set the desired language from the Language dropdown menu



   d. Set the RMS Current Measurement method (ORIGINAL or ISO17657). The default is ORIGINAL.

   e. Select the Curve Output Format (SIMPLE or DETAILED). SIMPLE is the default selection.

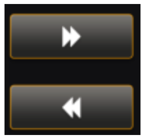
   f. Set the initial passwords for the **Supervisor**, **User**, and **Calibration**.
      i. Enter the current password into the field **Supervisor Password**
      ii. Enter the new password in the **New Password** field
      iii. Enter the new password in the **Confirm Password** field
      iv. Tap the **UPDATE** icon for the password type to update
   g. Set the **Timeout for all Passwords** to your desired time.
   h. Tap the **Password Switch** to disable the password requirements to enter secured menus

Password Switch
To ease navigation during the setup and installation, the menu security can be diasabled by tapping the **Password Switch** button. Remember to enable the **Password Switch** after the setup is complete.

6) Configure the Display Settings and the Time Settings
   a. From the **SYSTEM SETUP** page, tap the **USER** icon in the footer menus
   b. Set the desired **Brightness Level** from the drop down menu
   c. Set the desired **Screensaver Time** ranging from 10 minutes to 999999 minutes
   d. Set the **Date - Time Settings**

e. Tap **CONFIRM** to save the date and time updates

7) Configure the **SECURITY SETTINGS** for each of the Alarms
   a. Each Alarm can be classified as a **USER LEVEL** or **SUPERVISOR LEVEL**. For the Alarm to be cleared, the corresponding password will be required (**SUPERVISOR** or **USER**).
   b. Tap the desired Alarm to move and the tap the arrow icon to move between a **USER LEVEL** and **SUPERVISOR LEVEL**.



8) Set Program Parameters
   a. The device cannot monitor and measure the welding process until it has been correctly configured with program specifications. Set the mandatory parameters such as trigger mode, measurement type, and pulse type. (Key configurations are in bold type)
   b. To enter the Program Settings page from the Monitor Page perform the following actions:
      i. Tap **SETUP** on the footer menu
      ii. Tap **PROGRAM** on the footer menu
         1. The supervisor user password may be required
      iii. The **EDIT PROGRAM SETTINGS** page will appear as shown in Figure 5. Table 17 provides a summary of all the fields on the page.

Figure 5: Edit Program Settings Screen

Image Label	Field Name	Value	Dependency	Description
(1)	Prg Number	0-999	N/A	A total of 1000 set-up groups (0-999) of specifications can be set. The entire group of specification parameters can be copied using the COPY icon
(2)	Name	String	N/A	Set the program name if required. The name is visible when reviewing recorded data.
(3)	Measurement Type	DC / AC / CD	N/A	Supports three types: direct current (DC), alternating current (AC), and capacitor discharge welding.
(4)	Trigger Mode	Current / Force	N/A	There are two types, namely current trigger and force trigger to start the recording of the weld.
(5)	Current Range	6KA 20KA 60KA 200KA 1000KA	N/A	Defines the selected current measurement range. The range selected should be the closest to the weld current of the application and greater than your weld current.
(6)	Voltage Range	20V 60V	N/A	Defines the selected voltage measurement range. The range selected should be the closest to the voltage during the measured weld and greater than the voltage.
(7)	Pulse Mode	Single Multi Specify	N/A	**Three modes are supported:** **Single pulse –** A measurement is completed once a current pulse is captured in the current trigger mode **Multi-pulse –** A measurement is completed when the number of current pulses captured in the current trigger mode reaches the set number of pulses **Specified pulse –** A measurement is completed when the number of current pulses captured in the current trigger mode reaches the set specified number of pulses. In addition, only the data of the specified pulses are calculated and the curves of the specified pulses are displayed In addition, in the pressure trigger mode, the measurement will not be completed when the number of captured current pulses reaches the set number of pulses; instead, it will be completed when the pressure drops to the force drop level.

(8)	Total Pulses	1-10	Pulse Mode = Multi	The maximum number of current pulses in one measurement ranging from 1 to 10. The pulse mode must be set to Multi to set this field.
(9)	Measure Pulse	1-10	Pulse Mode = Specify	The maximum number of current pulses in one measurement ranging from 1 to 10. The pulse mode must be set to Specify to set this field. The specified number of pulses must not exceed the number of weld pulses programmed in the weld control.
(10)	Current Calcu	Auto Custom	Measure Type = CD	There are two current calculation modes: **Automatic mode:** No need to set the start and end cycles, and the device will calculate automatically using algorithms. **User-specified time mode:** In this mode, the start and end cycles need to be set on the pulse setting page.
(11)	Current Sync	10 – 90%	N/A	The percentage of the current peak value, used to calculate the current RMS value. The default is 10%.
(12)	Current End	1.5 – 15%	Trigger Mode = Current	The end level is the percentage value of the current range. It is the judgment condition for the end of a single pulse in the current curve. This field is only valid when the Trigger Mode is set to Current.
(13)	Force Rise	5 – 20%	Trigger Mode = Force	The force rise level value is the percentage value of the selected force range, which is the trigger condition for starting measurement in trigger. This field is only valid when the Trigger Mode is set to Force.
(14)	Force Drop	5 – 20%	Trigger Mode = Force	The force drop level value is the percentage value of the selected force range, which is the trigger condition for ending measurement in force trigger. This field is only valid when the Trigger Mode is set to Force.
(15)	Disp Delay	ON/OFF	Measure Type = AC	Enabling this switch Displacement Delay Switch field allows the user to set the Displacement Delay Time clock to extend the measurement time even after current or force end conditions have been met. This allows the Hi5 to record the change in displacement during the cooling of the weld.
(16)	Disp Time	0-2000msec	Measure Type = AC	The Displacement Delay Time defines the additional recording time after the current or force end condition is met. The additional time can be set from 0 – 2000 msec. The Displacement Delay switch must be ON to use.
(17)	Frequency	5-400Hz	Measure Type = AC	Only valid when the measurement type is AC. Set the frequency of the welding current to 50 or 60 Hertz.
(18)	Delay Trig Time	0-2000msec	N/A	Set the delay time after the measurement ends (0-2000ms). It is not set normally.

(19)	Custom Fields	String	N/A	5 custom fields are used to save user-defined information, which can be set when needed.
(20)	Force Range			Displays the force range, which is configured during the sensor type adaptation stage.
(21)	Copy Data to Prg	0-999	N/A	Set the program number (0-999) of the set-up parameters to be copied, click the copy button, a pop-up window will prompt for confirmation, and the program set-up copying function will be completed after confirmation.

Table 17: Program Settings Field Definitions

iv. When using the unit is set to Multi or Specify Pulse Mode, the Pulse Data settings must be configured. To enter the Pulse Data Settings page tap **PULSE PERIOD DATA SETTINGS.**

1. **Pulse period data setting:** Set the start and end time of the current pulse for set-up parameters to calculate the current pulse data. This must be set. It needs to be set according to the actual welding time. For a medium-frequency DC welding machine with a welding time of 100ms, the start cycle is generally set to 10ms and the end cycle to 100ms. Set the target values of current, voltage, displacement, resistance, force, energy, and welding time. They are used to compare the actual values with the upper and lower limits to determine whether to generate an alarm, and can be not set when no alarm is needed.

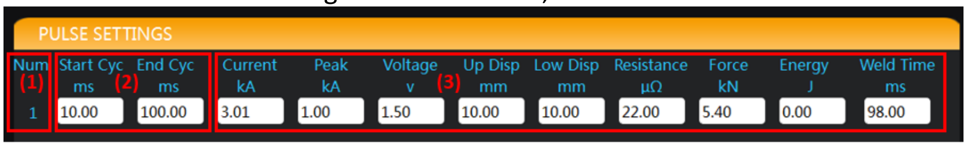


Figure 6: Pulse Settings Screen

Image Label	Field Name	Value	Dependency	Description
(1)	Current Pulse Number	0-10	Pulse Mode = Multi or Specify	This defines the current Pulse Number
(2)	Start Cyle & End Cycle	0 – 5000 msec DC-msec AC-cyc	Pulse Mode = Multi or Specify	Start cycle and end cycle. When the measurement type is DC or energy storage welding, the unit is ms; when the measurement type is AC, the unit is cyc.
(3)	Limits		Pulse Mode = Multi or Specify	Used to set the target value of pulse data for upper and lower limit for fault trigger. It is not necessary to set it when the upper and lower limit alarms are not set. In addition, on the pulse data page (path: **MEASURE - MEASUREMENT DATA** -> **HOLD DISPLAY** -> **PULSE DAT**), the specification pulse data can be automatically set through the synchronization button as shown in Figure 7.

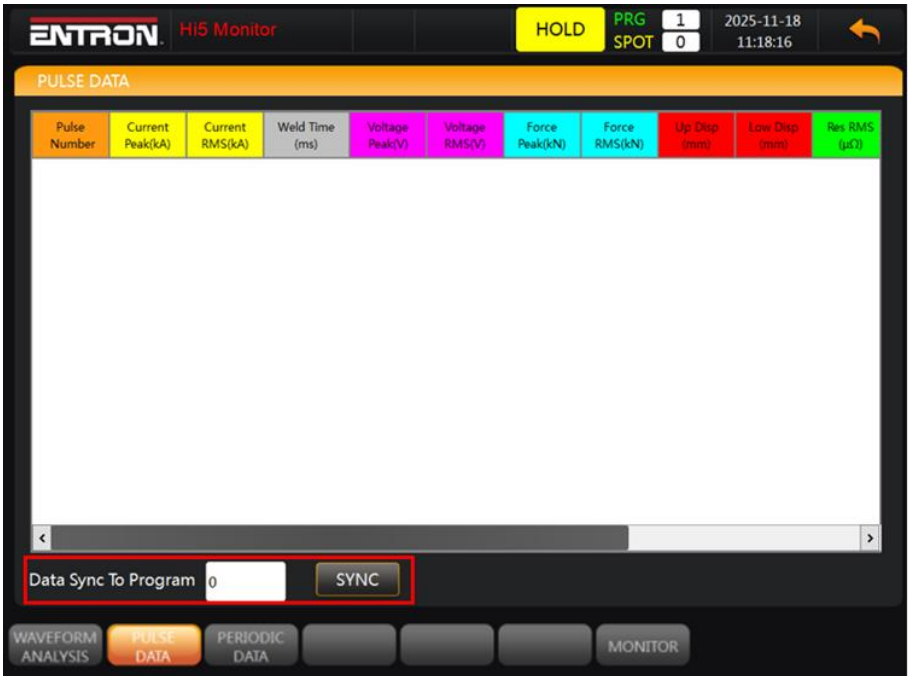
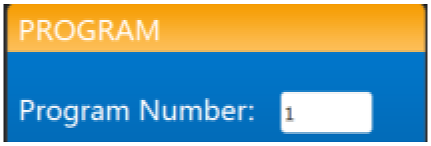


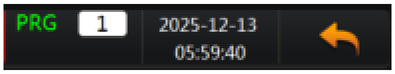
Figure 7: Pulse Data Page with Data Sync Function Highlighted

9) Set Measurement Specifications
    a. The Measurement Mode must be set to the desired Weld Program. This sets the active program that the Hi5 is monitoring.
    b. Navigate to the **MEASUREMENT MODE SELECTION** by tapping **SETUP** on the Measure Page. Then verify the **SELECT MODE OPERATION** is set to **PROGRAM** as shown below.

    c. Then set the **Program Number** to the program setup in the previous step.

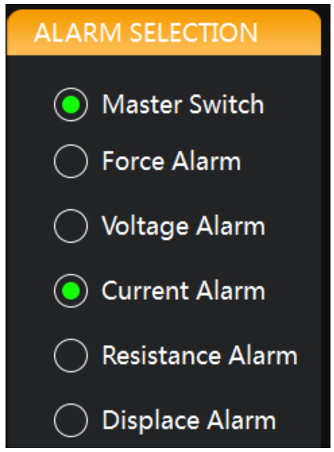


    d. The selected **Program Number** will now be synchronously displayed in the **PRG** field in the header menu.

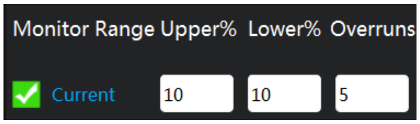


10) Execute a weld on the machine to confirm the Hi5 Monitor is being triggered and recording the welds
11) Navigate to the **EDIT ALARM PROGRAM MONITOR SETTINGS** from the Measure Page by tapping **SETUP**-> **PROGRAM** -> **ALARM PROGRAM** on the footer menu.
    a. Set the Program Number to the desired Program
    b. Enable alarm monitoring for the selected program by tapping Master Switch

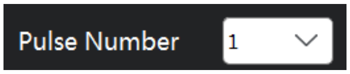
    c. Enable the additional signals for alarm monitoring by tapping each signal in the **ALARM SECTION**
        i. Note, this enables the alarm monitoring for the set weld program. For Pulsed welds, you can enable and disable the Alarm Monitoring individually for each weld pulse.



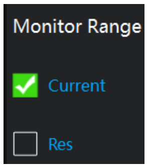
d. Set the **Upper%** and **Lower%** and **Overruns** values for each of the signals to monitor.
   i. The **Overruns** counts is the non-consecutive number of welds where a measured value violates the Upper% and Lower%.
   ii. Detailed information on the fields can be found in the **ALARMS** Section.



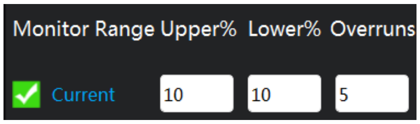
e. For **Pulsed Welds**, the limit parameters for each pulse must be independently set.
   i. Select the desired pulse from the drop-down menu



   ii. Enable the signals for Alarm Monitoring by tapping the signal



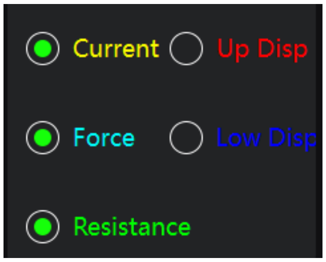
   iii. The **Upper%** and **Lower%** and **Overruns** must be set for each signal



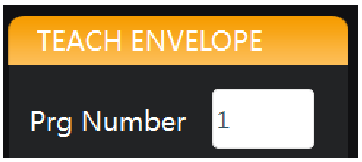
Pulsed Welds
The target values of the measured signals must be set individually for each pulse. The **Overruns** counts defines the number of non-consecutive welds where the limits has been exceeded. Even if the target is exceeded for multiple pulses during a weld, the overrun counter will only increase by one.

12) Set the target values for each signal by using the Generate Envelope function.
   a. Navigate to **ENVELOPE CREATE** page from the measure page by tapping **SETUP**-> **PROGRAM** -> **ENVELOPE CREATE**

b. The ENVELOPE CREATE function allows you to teach the target values for the selected Program Number with actual welds.
c. Select the signals that you want to teach by enabling the desired signals



d. Verify the welding machine is set to the proper weld program and is ready to weld parts
e. Verify the Hi5 Monitor is set to the correct weld program number



f. Tap the START WELDING button to begin recording the welds

g. Execute up to 10 welds on the welding machine
h. Each weld will be plotted on the graph. The user should evaluate the quality of each weld performed.
    i. If a weld made is not satisfactory, the weld should be deleted from the teach data set by using the **Previous** and **Next** icons to toggle through welds. The **Delete Sel Curve** will delete the curve from the data set.

i. Once you have built the data set to teach the target values, tap the **FINISH WELDING** icon to generate the limits for Alarm Monitoring

j. After the **CREATE ENVELOPE** function has been completed the device is now ready to monitor the Weld Program based on the Program Settings, Alarm Program Settings, and the Envelope Curve.
k. Repeat steps 5 to 9 for each Weld Program to be monitored

ENVELOPE CREATE
The ENVELOPE CREATE function is a powerful tool for setting the Alarm Monitoring limits based on actual weld data. The Upper% and Lower% values are applied to the ideal weld profile. This allows monitoring of the signals during each phase of the weld (i.e. upslope, weld time, and downslope).

13) Enable the **Password Switch** by following the next steps
   a. Tap the Monitor Return icon in the header menu

   b. Tap **System Setup** in the footer menu

   c. Enable the **Password Switch** by tapping

2.4.3 Communication Settings

The Hi5 Weld Monitor has READ-WRITE capabilities via MODBUS communication protocol. This allows the Hi5 Weld Monitor to communicate with a PLC. The Hi5 Monitor can also communicate via HTTP protocol. The communication is types and functionality are summarized in Table 18.

Hi5 Monitor's Role	Communication Type	Changing Program Parameters & Alarm Settings	Sending Data Curves	Sending Weld Summary
Modbus Client	Serial Port, Ethernet, and 4G	✓	✕	✓
HTTP Server	Ethernet and 4G	✓	✕	✕
HTTP Client	Ethernet and 4G	✕	✓	✓

Table 18: Network Communication Types & Functionality

The specific operation is configured on the communication configuration page ("**SYSTEM MANAGER**" -> "**COMM SET**"-> **NETWORK SETTINGS**) as shown in Figure 8.

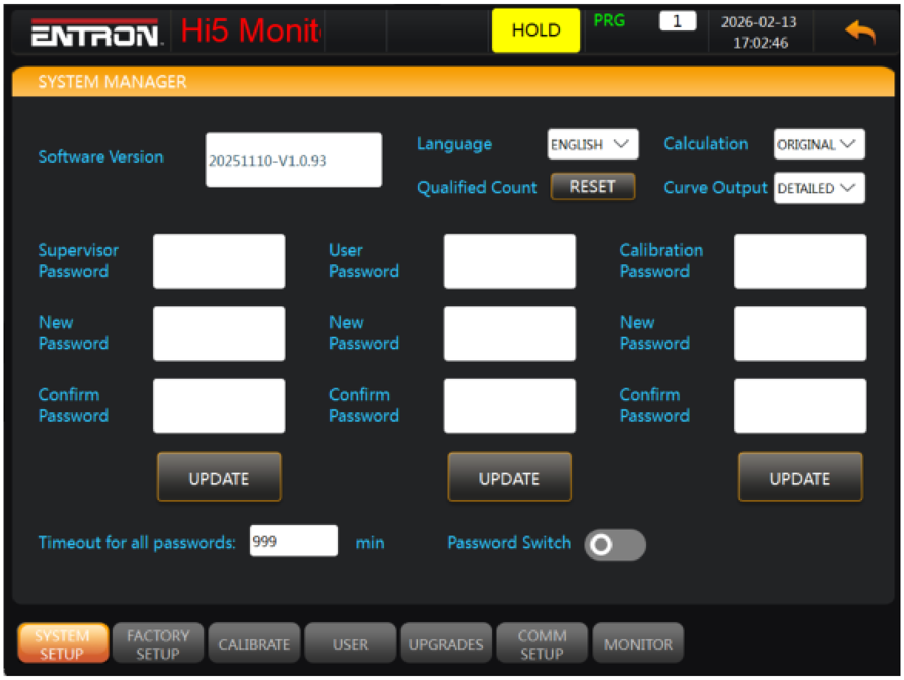


Figure 8: Communication Configuration Page

2.4.3.1.1 Modbus Steup via Serial Port

Hi5 Monitor can be configured as a Modbus Client via RS232 interface. The RS232 pinout can be found in the **RS232 SERIAL COMMUNICATION CONNECTION** Section.

The Serial Settings are defined at **SERIAL CONFIGURATION** field in Figure 8. The Slave Address is user modifiable and can be set between 1 and 255.

The Modbus data structure can be found in the **MODBUS** Section.

2.4.3.1.2 Modbus Setup via Ethernet or 4G network

The Ethernet and 4G networks use identical procedure to configure the Hi5 Monitor as a Modbus Client. Based on the network topology, the configuration procedure is classified into two scenarios:

- Same Subnet for Hi5 Monitor and Target Machine.
- Different Subnets for Hi5 Monitor and Target Machine.

2.4.3.1.2.1 Same Subnet for Hi5 Monitor and Target Machine

The Ethernet or 4G network configuration procedure only requires typing in the Hi5 Monitor's IP address, and then tap the **SET** icon.

2.4.3.1.2.2 Different Subnets for Hi5 Monitor and Target Machine

The Ethernet or 4G network configuration procedure requires typing in the Hi5 Monitor's IP address, and then tap the **SET** icon.

Next, type in the gateway, and then tap the **SET** icon.

If applicable, type in the DNS, and then tap the **SET** icon.

2.4.3.1.3 HTTP Server Setup

Hi5 Monitor can be configured as a HTTP Server via Ethernet or 4G networks. The configuration procedure is identical to **MODBUS SETUP VIA ETHERNET OR 4G NETWORK**.

2.4.3.1.4 HTTP Client Setup

After completing the HTTP server setup as defined in **SAME SUBNET FOR** Hi5 Monitor and Target Machine

The Ethernet or 4G network configuration procedure only requires typing in the Hi5 Monitor's IP address, and then tap the SET **icon.**

Different Subnets for Hi5 Monitor and Target Machine

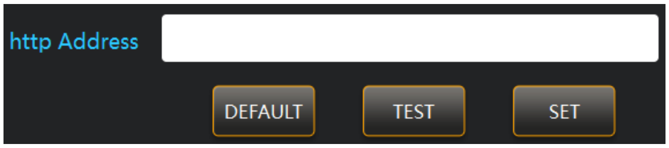
*2.4.3.1.4.1 The Ethernet or 4G network configuration procedure requires typing in the Hi5 Monitor's IP address, and then tap the **SET** icon.*

Next, type in the gateway, and then tap the SET icon.

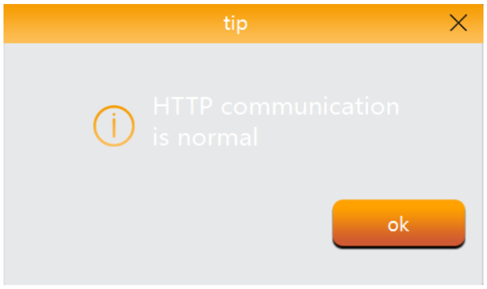
If applicable, type in the DNS, and then tap the SET icon.

HTTP Server Setup Section.

At the **http Address** field, type in the URL for the HTTP Server, and then tap the **SET** icon.

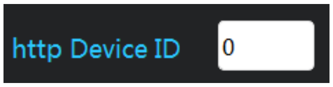


Tap the **TEST** icon. If the HTTP Client setup is successful, the following prompt will be shown on the Hi5 Monitor's screen.



Once the Hi5 monitor is configured as an HTTP Client and the **http Slave Switch** is on, data curves and weld summary will be automatically sent to the HTTP Server after each weld.

If multiple Hi5 Monitors are used as HTTP Clients, the **http Device ID** or **Machine ID** can be used to identify which Hi5 Monitor is the data source. The **http Device ID** can be chosen between 0 and 1024, while the **Machine ID** is read-only.



Notice that the Hi5 Monitor is allowed to be an HTTP Client and an HTTP Server simultaneously.

3 APPLICATION OVERVIEW

The Hi5 Weld Monitor is designed to allow weld engineers, weld setters and machine operators to visualize and analyze each weld performed on the machine. This data can be used to optimize your weld schedule and develop optimal quality control limits. The user-friendly touch screen interface allows you drill down to each millisecond of the weld and compare different recorded welds.

This section outlines how to navigate the user-friendly Hi5 Weld Monitor. The user should familiarize this section to get the most value out of the Hi5 Weld Monitor to improve your weld quality and process control.

The user navigates the Hi5 Weld Monitor via the touchscreen interface. The Hi5 Weld Monitor menu structure has five primary sections as defined in Table 19.

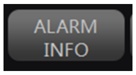
Hi5 Main Pages / Screens		Description
MONITOR		The **MONITOR** Page is the default page for the Hi5 Weld Monitor. The screen shows the plot of the last recorded weld. The screen auto-refreshes each time a weld is made to give the machine operator or weld engineer a complete view of their weld.
HOLD DISPLAY		**HOLD DISPLAY** is a variant of the Monitor Page. When Hold Mode is enabled the user can drill into the weld and analyze the data on the display page. The user can zoom into specific signals.
MEASURE SETUP		The **MEASURE SETUP** page allows the user to set up weld program specific information such as names of the weld program or workpieces. The **MEASURE SETUP** page also allows access to the **MEASUREMENT MODE SELECTION**, **PROCESS**, **PROGRAM** & **NAME VIEW** pages.
DATA MGMT		The **DATA MGMT** Page allows the user to view the DATA RECORD in a tabulated format.
ALARM INFO		The **ALARM INFO** page shows the details on the alarm detected by the device.
SYSTEM SETUP		The **SYSTEM SETUP** page contains the SYSTEM MANAGER settings. E.g security settings, communication setup, and calibration settings for each of the sensors.

Table 19: Measure Mode Menu Selections

3.1.1 Footer Navigation Panel

The footer of the Hi5 Weld Monitor display is used for menu navigation. As you navigate the Hi5 Weld Monitor screens, the menu navigation panel will change to show the available menu options for that level.

The main pages can be navigated quickly using the menu bar at the footer of the **MEASURE** page as shown in Figure 9.

Figure 9: Hi5 Monitor Menu Bar on Monitor Page

Hold Mode
Hold Mode is not a menu item. It is a special mode of the Monitor page that allows the user to analyze the weld data of the weld currently on the monitor page.

Available menu items from the current screen are shown with a grey background. The active menu item is highlighted in orange. For a complete view of the menu structure refer to the menu topography in the **APPLICATION TOPOGRAPHY** Section.

3.1.2 Real Time Status Information on Header

The real time status information on the Hi5 Weld Monitor contains critical information for navigation and status of the Hi5 Monitor. The definition of each item on the Real Time Status Header is defined in Table 20.

Figure 10: Real Time Header of Hi5 Monitor

Item	Symbol	Description
Operating Status	MEASURE HOLD WELD ALARM	The Operating Status of the Hi5 Weld Monitor is displayed to identify the current state. • MEASURE mode • HOLD Mode • WELD ALARM in Progress
Triggered Status	Triggered	The Triggered notifier will appear on the screen when the Hi5 Weld Monitor is actively collecting data.
PRG	PRG 0	The PRG value defines the measurement program currently in use.
SPOT	SPOT 0	The SPOT value is a counter defining the number of recorded welds completed on a part when in work cycle mode.
Date and Time	2025-11-19 13:49:24	The data and time are displayed. This is the value of the internal clock used for time stamping each weld recorded.
Return	↩	The return symbol is used for navigation back to the previous page.

Table 20: Real-Time Header Icons and Data

3.1.3 Application Topography

A graphical view of the Hi5 Weld Monitor topography is shown in Figure 11.

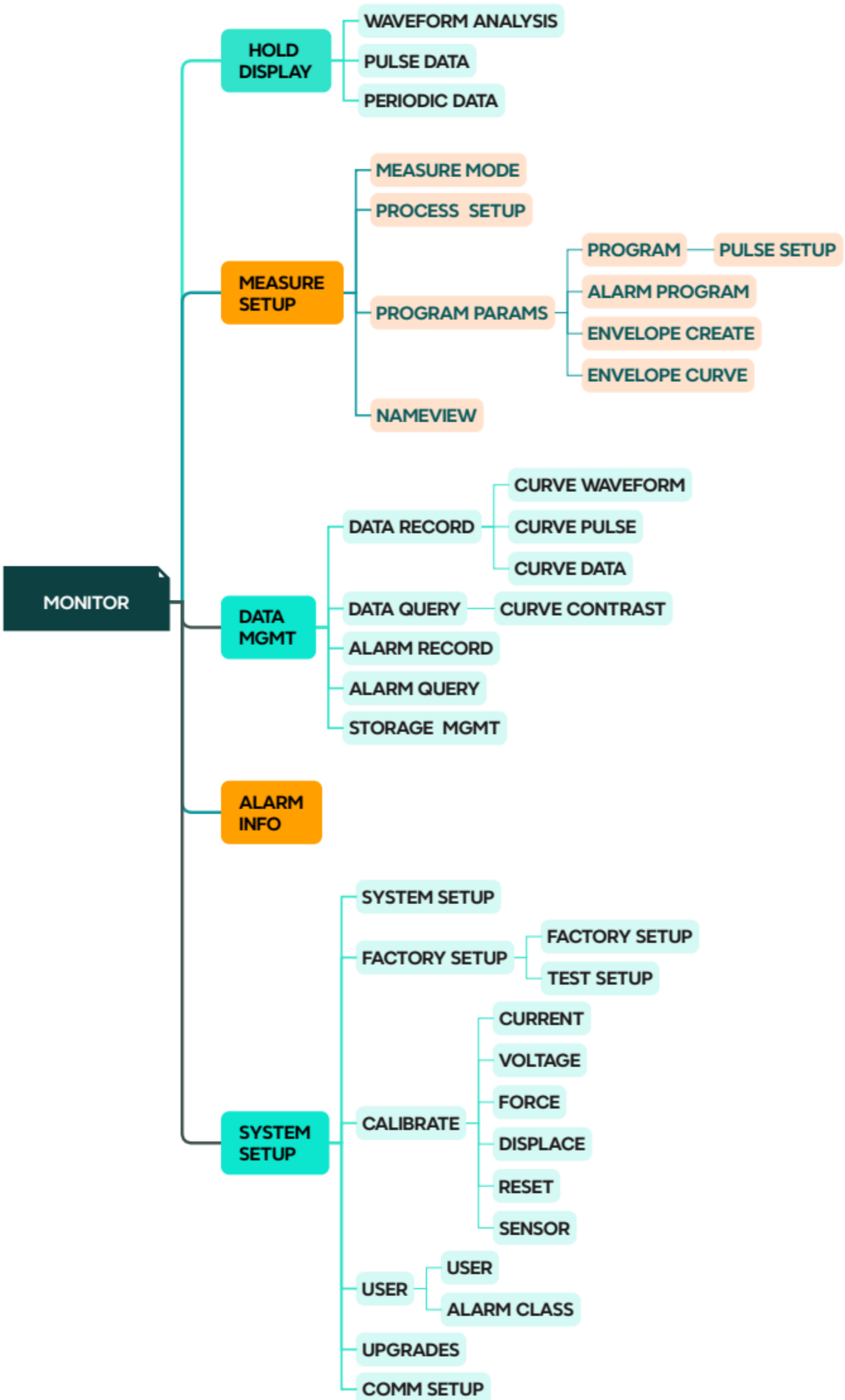


Figure 11: Hi5 Monitor Navigation Topography

3.1.4 Monitor Page

The Monitor Page is the primary screen of the Hi5 Weld Monitor. It shows the plot of the last recorded weld. This screen allows weld engineers, weld setters and machine operators to visual the weld and see summarized information for all of the weld signals recorded.

The **MONITOR** - **MEASURE** page has four primary sections as shown in Figure 12 and defined in Table 21.

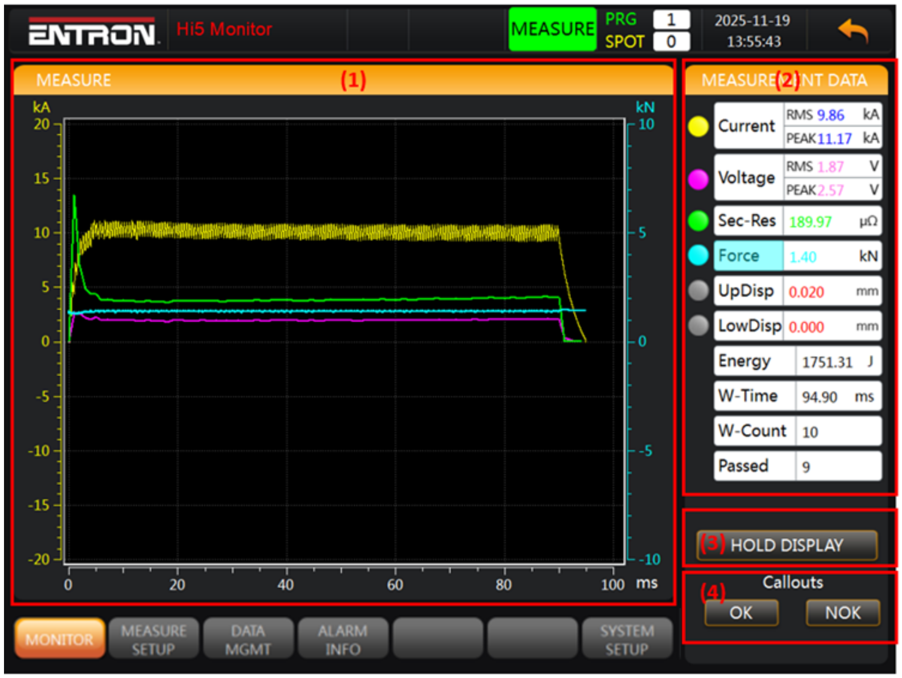


Figure 12: Monitor Page

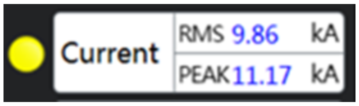
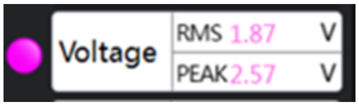
Description	Section Number	Description
MEASURE	1	The **MEASURE** section shows the plot of the enabled weld signals over time.
MEASUREMENT DATA	2	The **MEASUREMENT DATA** shows the average or peak measured values from the last weld.
HOLD DISPLAY	3	The HOLD DISPLAY icon is used to change the Monitor into Hold Mode to allow the user to drill into the recorded weld current and analyze the data on the display on the Monitor page.
Callouts	4	The callouts section allows the user to classify the weld by selecting the OK and NOK icons. This feature is powerful, allowing labeling of the weld data for future analysis.

Table 21: Monitor Page Icons

3.1.4.1 *Measured Data Overview*

The **MEASUREMENT DATA** section of the monitor page defines the summarized signals of the weld. A detailed definition of each of the measured signals is Table 22.

Quickly Hide and Show Signals on the Graph
The Hi5 Weld Monitor page can display on the signals you want. The user can tap the colored circle icon next to each value to show or hide the signal on the plot.

Signal	Icon	Definition	Units
Current		Displays the root-mean-square (RMS) value of the weld current. This is calculated based on the Start Time and End Time settings for the weld schedule. The peak value of the current for the specified pulse for the weld. This is defined in the program pulse settings.	Kiloamps (kA)
Voltage		Displays the root-mean-square (RMS) value of the weld voltage. This is calculated based on the Start Time and End Time settings for the weld schedule. The peak value of the voltage for the specified pulse for the weld. This is defined in the program pulse settings.	Volts (V)
Secondary Resistance		Displays the root-mean-square (RMS) resistance value of the weld. This is calculated based on the Start Time and End Time settings for the weld schedule. The weld pulse resistance is calculated, and can be configured in the program pulse settings.	Resistance (µΩ)
Force		Displays the root-mean-square (RMS) value of the weld force. This is calculated based on the Start Time and End Time settings for the weld schedule. The weld pulse the force is calculated for can be configured in the program pulse settings.	Kilogram-force (kgf) Kilonewtons (kN)

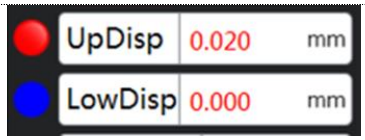
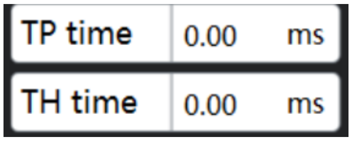
		The unit of measurement is configurable in the system settings	Pounds-force (lbf)
Displacement		Displays the post-weld upper and lower displacement of the material welded.	Millimeters (mm)
Energy		Measures the energy over the entire weld.	Joules (J)
Weld Time		Measures the sum of the weld times of all pulses for one program. When measuring no current, the weld time is 0.	Milliseconds (ms)
Reservior Peak Time and Captive Weld Time		**The TP and TH times are only valid when the measurement type is CD.** TP time (Reservoir Peak Time): displays the peak time of the first pulse or the specified pulse. TH time (Captive Weld 1/2 Peak Time): displays the 1/2 peak time of the first pulse or specified pulse.	Milliseconds (ms)
W-Count		Records the total number of Weld measurements.	Each
Passed Count		The number of qualified measurements is recorded and can be cleared on the System Management page.	Each

Table 22: Measured Data on Monitor Page Overview

3.1.5 Hold Mode

Hold Mode is a critical feature of the Hi5 Weld Monitor. This mode allows weld engineers, weld setters and machine operators to drill down into the previous weld to gain insights into the weld. These insights can be used to optimize the weld schedule or pinpoint the root cause of a bad weld.

There are three pages available when Hold Mode has been enabled. These modes allow the user to view the data graphically, by weld pulse, or a time series of data. The Hold Mode screens are defined in Table 23.

Menu Item	Symbol	Description
Waveform Analysis		The **Waveform Analysis** page allows the user to analyze each millisecond of the weld. The user can zoom in and out to visualize the weld. The cursor can be moved to see measurements at a specific point in time.

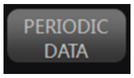
Pulse Data		The **Pulse Data** page allows the user to analyze the summarized signals by the weld pulse for the weld selected for Hold Mode.
Periodic Data		The **Periodic Data** page allows the user to see the value of each signal at each millisecond for the weld in a tabulated format for the selected weld.

Table 23: Hold Mode Menu Icons

To navigate to the different Hold Menus, use the footer Navigation Bar to move between the Hold Mode screens.

Figure 13: Footer Navigation Menu Bar in Hold Mode

Active Menu Shown in Orange
The the Active Menu item is highlighted in orange. The grey icons show different ways to view the weld selected for Hold Mode.

3.1.5.1 Waveform Analysis Page

The Waveform Analysis page allows the user to analyze each millisecond of the weld. Hold Mode is enabled by selecting the Hold Mode icon from the Monitor page. On the Waveform analysis page the user can:

- Hide and show signals by clicking the colored circle
- Zoom the window in and out
- Enable cursor mode, to move the cursor over the weld to see measurements at a specific point in time
- View the envelope curve (i.e. limits) on the weld signals
- Disable cursor mode, to view summarized values for all the signals

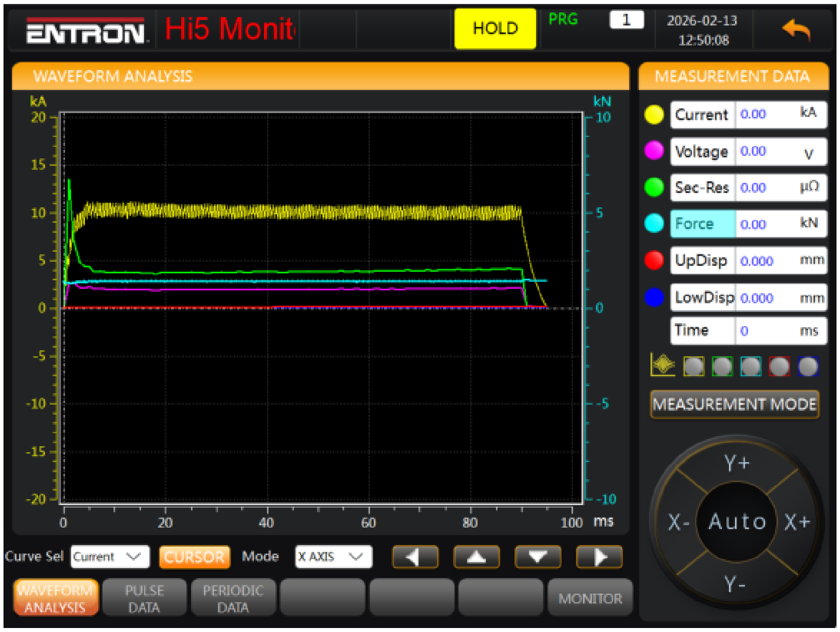
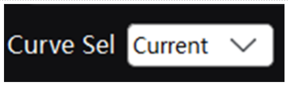
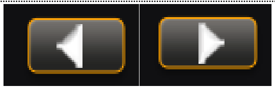
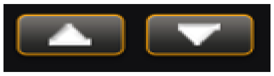
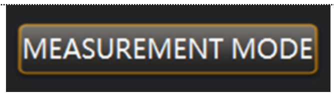
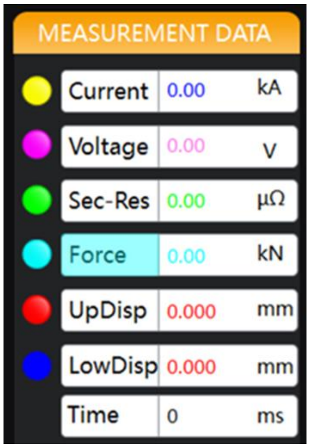


Figure 14: Hold Mode Waveform Analysis Screen

The definition and function of each of the icons shown on the Hold Mode page are defined in Table 24.

Icon Name	Symbol	Description
Curve Selection		Tap on the drop-down box to select the curve to be manipulated.
Left-Right Arrows		Use the Left and Right icons to shift the graphic left or right along the time axis.
Up-Down Arrows		Use the Up and Down icons to shift the graphic up or down along the y-axis.
Measurement mode		Tap the monitor button to return to the Monitor page.
Cursor	 	Switch cursor mode on/off by tapping the icon. The cursor mode is enabled when it is highlighted in orange. When cursor mode is enabled, the measurement data will display values based on the location of the cursor on the graph.
Measurement Data		This section shows the measured values from the weld. The data values are based on the selections of cursor mode and pulse selection. The curves can be shown or hidden by tapping the colored circles. When **Cursor** mode is off, the measured data is displayed for the currently selected weld pulse. When **Cursor** mode is on, the measured data is displayed for the time stamp selected with the cursor.
Pulse Selection		The pulse selection setting allows the user to select the pulse to be analyzed. **Cursor** mode must be off to change pules.
Curve Signals Enabled		The user can hide and show defined weld envelope or limits by tapping the colored circle in the Envelope Icon. The colors for each measurement correspond to the colors on the measurement data panel. **Current:** yellow **Resistance:** green

		Force: cyan **Upper displacement:** red **Lower displacement:** blue
Zoom		The user can zoom in and out by using the buttons on the zoom icon. The Auto button can be used to automatically adjust the x and y axis to fit the data set. **Y-axis zoom-in operation:** Y+ **Y-axis zoom-out operation:** Y- **X-axis scaling:** X- and X+ **Auto adjusts x and y axis:** Auto

Table 24: Hold Mode Page Icons and Functions Overview

3.1.6 Pulse Data Page

The Pulse Data page allows the user to see the measured weld values for each weld pulse of the selected weld. Thus, allowing the user to see RMS and peak values for the various pulses of the weld. When welding Advanced High Strength Steels and other difficult to weld materials where pulses are used, the Hi5 Weld Monitor allows you to view the weld pulse by pulse.

To navigate to the Pulse Data page, the user should select the 

icon.

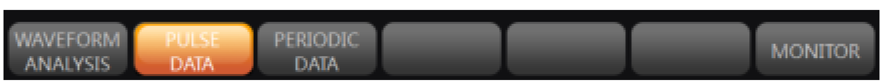


Figure 6: Footer Navigation Menu Bar in Hold Mode with Pulse Data Page Selected

An example of the Pulse Data page is shown in Figure 15. The Pulse Data page shows the following signals for each weld pulse. The RMS values are Root Mean Square values. The peak values show the peak value measured during the pulse.

- Pulse Numbers
- Peak Current
- RMS Current
- Weld Time
- Peak Voltage
- RMS Voltage
- Peak Pressure
- RMS Pressure
- Upper Displacement
- Lower Displacement
- Energy Value
- RMS Resistance
- TP Time for CD Welding
- TH Time for CD Welding

Figure 15: Pulse Data Page

The user can push the collected Pulse Data to the Pulse Settings for the selected program. This allows the user to use weld data to set the limits for the Hi5 signals for each specific pulse of the weld. Refer to section **PULSE SETTINGS** for more information.

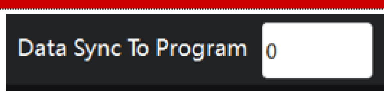
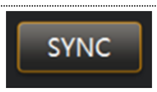
Icon Name	Symbol	Description
Data Sync to Program		Defines the program to sync the weld data with.
Sync		Sync pulse data to the parameters of the set program number.

Table 25: Pulsed Data Page Icons and Functions Overview

3.1.7 Periodic Data Page

The Periodic Data page allows the user to see each millisecond of the weld selected for Hold Mode.

To navigate to the Periodic Data page, the user should select the  icon.

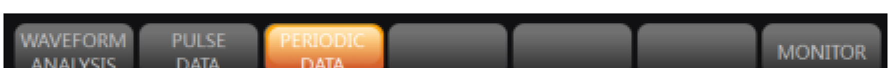
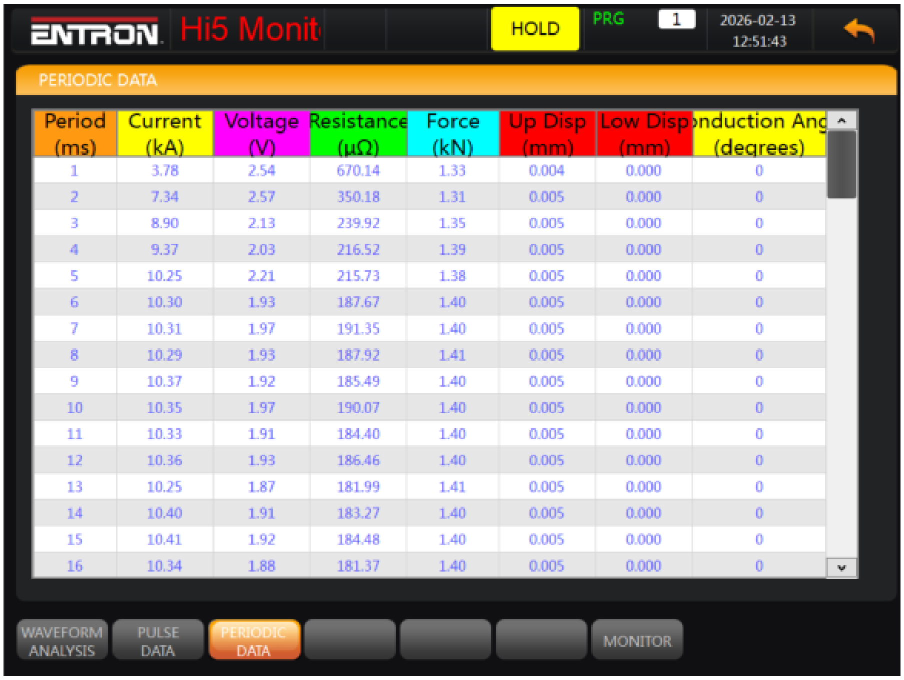


Figure 16: Footer Navigation Menu Bar in Hold Mode with Period Data Page Selected

The data is displayed as a table in the Period Data page. The user can navigate through the rows using the sliding bar on the right of the table. An example of the periodic weld page is shown in Figure 17.

Signal Displayed are a Function of Current Measurement Type
The signals displayed on the Periodic Data page are based on the current measurement type. For an MF DC weld, the firing angle or electric degrees will not be displayed.



Period (ms)	Current (kA)	Voltage (V)	Resistance (μΩ)	Force (kN)	Up Disp (mm)	Low Disp (mm)	nduction Ang (degrees)
1	3.78	2.54	670.14	1.33	0.004	0.000	0
2	7.34	2.57	350.18	1.31	0.005	0.000	0
3	8.90	2.13	239.92	1.35	0.005	0.000	0
4	9.37	2.03	216.52	1.39	0.005	0.000	0
5	10.25	2.21	215.73	1.38	0.005	0.000	0
6	10.30	1.93	187.67	1.40	0.005	0.000	0
7	10.31	1.97	191.35	1.40	0.005	0.000	0
8	10.29	1.93	187.92	1.41	0.005	0.000	0
9	10.37	1.92	185.49	1.40	0.005	0.000	0
10	10.35	1.97	190.07	1.40	0.005	0.000	0
11	10.33	1.91	184.40	1.40	0.005	0.000	0
12	10.36	1.93	186.46	1.40	0.005	0.000	0
13	10.25	1.87	181.99	1.41	0.005	0.000	0
14	10.40	1.91	183.27	1.40	0.005	0.000	0
15	10.41	1.92	184.48	1.40	0.005	0.000	0
16	10.34	1.88	181.37	1.40	0.005	0.000	0

Figure 17: Periodic Data Page for MF DC Weld

4 MEASUREMENT SETTINGS

The Measurement Settings menu allows the user to set up weld schedule specific parameters, data labeling, alarms, and the envelope curves for the unit. This section defines how to set up the Hi5 Weld Monitor to monitor a specific weld sequence and ensure your welds are measured and monitored within the defined limits for a quality weld.

4.1 Measure Mode

The Hi5 Weld Monitor has two measurement modes. The Measurement Mode defines the correlation between the weld program and the parameters set for the weld program. In other words, it ties the process parameters to the weld you are making.

The Hi5 Weld Monitor can monitor a single weld schedule which is ideal when a user welds a single weld on the workpiece using a common program. However, in today's world many applications are more complex. The Hi5 Weld Monitor can also support monitoring a series of different weld programs run sequentially on a single workpiece.

The two measurement modes are defined in Table 26.

Measurement Mode	Definition
Program Number	The device always measures with the currently selected weld program. This mode is designed for use when a machine welds parts using a consistent program on the workpiece.
Workpiece Cycle	Each workpiece number has a set of programs that are used to weld the workpiece. Workpiece mode is ideal for cases where a set of different programs are used to make discrete welds performed in a sequence on a workpiece. For quality assurance, each distinct weld on the workpiece is monitored and stored.

Table 26: Measurement Modes Overview

The Measurement Mode screen can be quickly accessed from the Monitor page. The steps to navigate to the page are shown below in Table 27.

Step	Icon	Description
1	MEASURE SETUP	Starting at the Monitor page, select the MEASURE SETUP icon from the Footer Menu bar.
2	MEASURE MODE	Select the MEASURE MODE icon from the Footer Menu Bar to enter the Measurement Mode Selection page

Table 27: Measurement Mode Menu Icons

The Measure Mode Selection screen is shown in Figure 18.

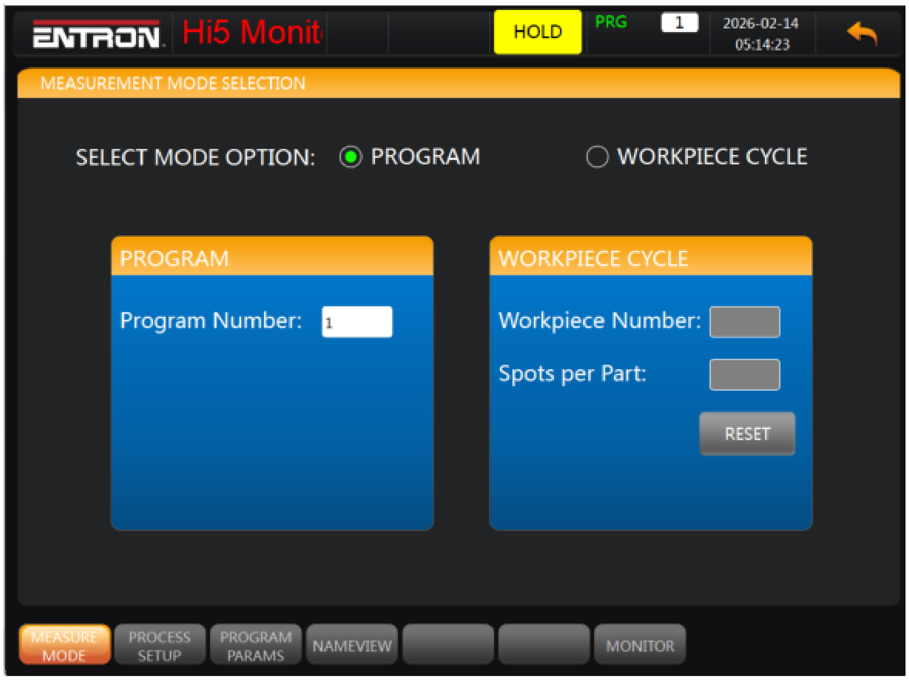


Figure 18: Measure Mode Selection Screen

4.1.1 Program Number Mode

The device always measures with the currently selected weld program. This mode is designed for use when a machine welds parts using a consistent program on the workpiece.

Update the Program Number During Changeovers
When the welder is changing jobs and a new weld schedule/program will be used, the operator should change the program in the Hi5 Weld Monitor to ensure the weld is monitored against the correct process parameters.

The Hi5 Monitor Weld Monitor can monitor up to 1000 weld programs.

Table 28 shows the icons used to set the Measurement Mode and define the Program for the weld to be measured and monitored.

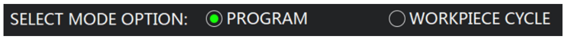
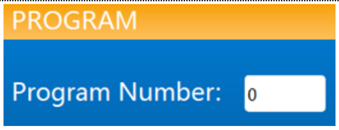
Setting	Icon	Description
Measurement Mode		Used to select the mode required.
Program Number		Sets the measurement program number (0-999) when the currently selected mode is program number mode.

Table 28: Measurement Mode Icons

After selecting the Program Mode and Program number, the setup for this specific program is completed in the Program menu. For more information see the **PROGRAM SETTINGS** Section. This is where you will define detailed information about the weld program and the corresponding weld envelope limits for alarms.

4.1.2 Workpiece Cycle Mode

One bad weld on an assembly can result in costly scrap or rework. Workpiece Cycle Mode allows you to identify a bad weld on the workpiece and alert you to stop. Do not waste additional time and energy on a workpiece with a defective weld.

Workpiece Cycle Mode is designed to be used for cases where a set of different programs are used to make discrete welds performed in a sequence on a workpiece. This allows the data to be linked to the workpiece or job and record each individual weld performed on the workpiece.

Up to 30 workpieces can be monitored. Each workpiece can contain up to 50 spots (i.e. welds).

Table 29 shows the icons used to set the Workpiece Cycle Measurement Mode and define the Program for the weld to be measured and monitored.

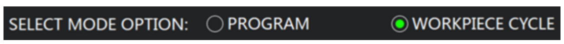
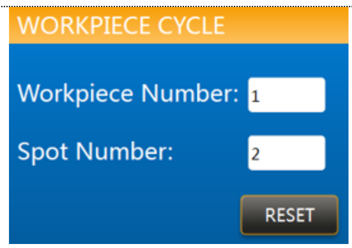
Setting	Icon	Description
Measurement Mode		Used to select the mode required
Program Number		The Work Number defines the workpiece that parameters are being defined for. The user can monitor up to 30 workpieces. The workpiece can have up to 50 spots (i.e. welds) monitored.
Reset		The spot number will be reset to 1 when the icon  is tapped. The corresponding weld program for spot 2 will need to be set in the Process page.

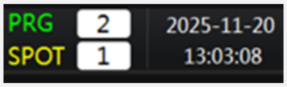
Table 29: Workpiece Measurement Mode Icons

Once the user has selected Workpiece Cycle Measurement mode, the individual spots must be correlated with the weld program parameters for that program. This correlation is set in the Process Settings.

4.2 Process Settings

The Process Settings page is used to correlate the Spot Number for the Workpiece to the Program (i.e. Schedule). The Program (i.e. Schedule) contains the parameters and limits specific to the weld.

Weld Program (i.e. Program) & Spot Always Visible
A user always has visibility to the Program and Spot correlation. The Weld Program (PRG) and the Spot number of the workpiece is (**SPOT**) being monitored are always shown in Real time Monitoring header of the Hi5 Monitor.



The Workpiece Process Setting screen can be quickly accessed from the Monitor page. The steps to navigate to the page are shown below in Table 30.

Step	Icon	Description
1		Starting at the Monitor page, select the MEASURE SETUP icon from the Footer Menu bar.
2		Select the PROCESS SETUP icon from the Footer Menu Bar to enter the Process Setting page

Table 30: Workpiece Process Setting Menu Icons

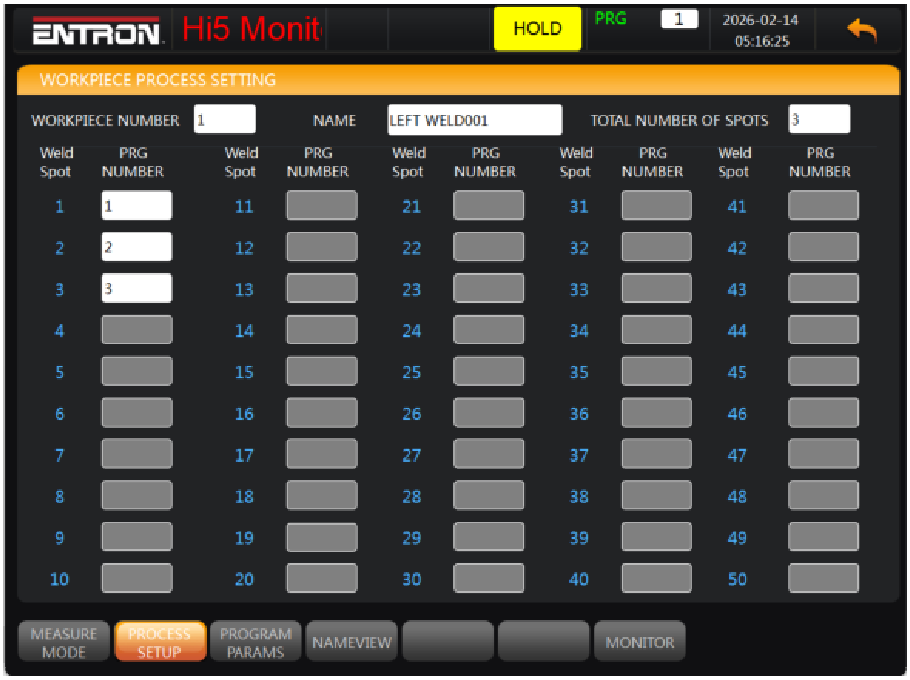


Figure 19: Process Settings Screen

The editable parameters on the Workpiece Process Settings page are defined in Table 31.

Setting	Icon	Description
Workpiece Number	WORKPIECE NUMBER [1]	A total of 30 workpiece numbers (1-30) are available to be set up the monitor.
Name	NAME [LEFT WELD001]	Each workpiece can have the part number or data identifier tagged to the monitored date. Enter your part number or SKU here. Workpiece names can be up to 50 letters or numbers.
Total Number of Spots	TOTAL NUMBER OF SPOTS [3]	The total number of spots on the part (1-50) needs to be set for each part number. Example: Set to 3, spot 1 to spot 3 allows the measurement program number to be entered.
Spot Number - Program	Weld Spot 1, PRG NUMBER [1]	Set the measurement program number of each spot.

Table 31: Workpiece Process Setting Parameters

After the relationship between each spot on the workpiece has been defined, the user will need to define the parameters for each weld program in the **PROGRAM SETTINGS** section.

4.3 Program Settings

The Edit Program Settings page is used to set the specific parameters of the weld program. It defines critical information of the weld and the range of the measured signals. A unique Program must be defined for each weld schedule from the control to be monitored and recorded.

Program Must Be Setup to Measure
The Hi5 Monitor cannot take any measurements until a Program has been defined because the Hi5 needs to know the type, range, and trigger to activate the recording.

The Program Setting screen can be quickly accessed from the Monitor page. The steps to navigate to the page are shown below in Table 32.

Step	Icon	Description
1	MEASURE SETUP	Starting at the Monitor page, select the MEASURE SETUP icon from the Footer Menu bar.

2	PROGRAM PARAMS	Select the PROGRAM PARAMS icon from the Footer Menu Bar to enter the Program Setting page.

Table 32: Program Settings Menu Icons

Figure 20 shows the Edit Program Settings page.

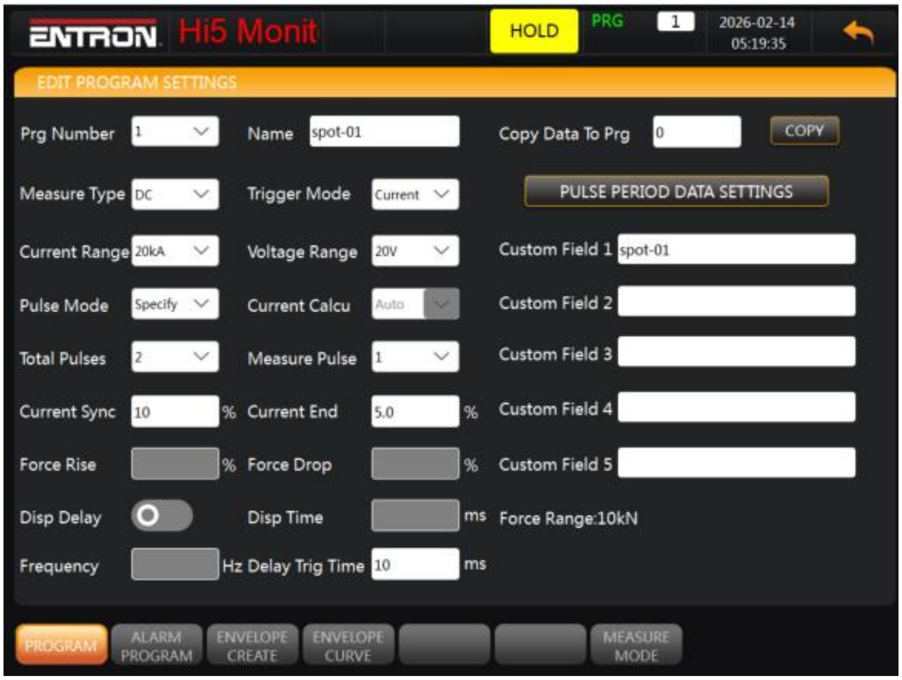
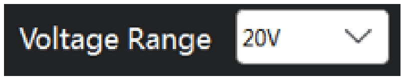
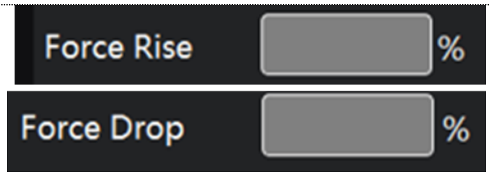


Figure 20: Program Settings Page

Table 33 defines all the settings on the Program Settings page.

Setting	Icon	Description
Weld Program Number	Prg Number 0	There are 1000 program numbers in total (0-999) Switching program numbers will refresh the data on the entire page.
Weld Name or ID	Name	Program names are allowed to have up to 50 letter or numbers. This allows you to identify each weld with an ID number.
Measurement Type	Measure Type DC	There are three types of measurements: DC, AC, and CD. Compatible with MF & 3 Phase DC welder, AC welder and Capacitor discharge welder.
Trigger Mode	Trigger Mode Current	There are two types of trigger modes. Current trigger and force trigger.
Current Range	Current Range 6KA	The current supports five ranges: 6kA, 20kA, 60kA, 200kA, 1000kA

Voltage Range		The voltage supports two ranges: 20V and 60V
Delay Trigger Time		Set the delay trigger time (0-2000ms) after the end of measurement. For example, if the setting is 200ms, the next weld does not trigger the new measurement-until 200ms after the previous measurement ~~is~~ was completed.
Force Rise Force Drop		Valid only when the trigger mode is force triggered. The rise and fall level values are percentage values of the force level. They define the start and end conditions for force triggering.
Frequency		**Valid only when the measurement type is AC**. Sets the frequency of AC. (Note: Select 50 or 60 HZ)
Current Calculated Mode		**Valid only when the measurement type is CD.** There are two modes of current calculation: 1. Auto, where there is no need to set the start and end cycles, and the device calculates them on its own using an algorithm. 2. custom, which means user-specified time mode, this mode requires the start and end periods to be set in the Pulse Setup page.
Current Sync		Percentage of the peak current value used to calculate the current RMS value.
Current End		**Valid only when the trigger mode is current.** The end level is a percentage value of the current profile. It is a judgment condition for the end of a single pulse of the current profile.
Pulse Mode		Pulse mode is used to calculate the current pulse. **Force trigger mode is not subject to this limitation.** Pulse mode supports three modes: 1. Single pulse (current trigger mode captures a single current pulse to complete a measurement) 2. Multi-pulse (current trigger mode captures the number of current pulses up to the set number of pulses to complete a measurement) 3. Specified pulse (A measurement is completed when the number of current pulses captured by the

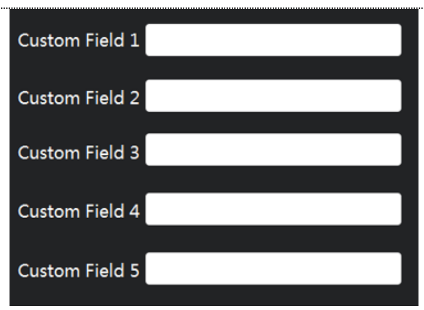
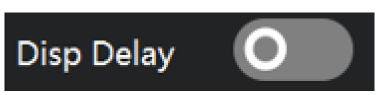
		current trigger mode reaches the number of specified pulses set. In addition, only the data of the specified pulses is calculated and the curve of the specified pulses are displayed).
Total Number of Pulses		**Valid only when the pulse mode is multi-pulse.** Number of pulses in the range (1-10)
Specify Pulses		**Valid only when the pulse mode is the specified pulse.** Specify the number of pulses in the range (1-10). **Note:** Specifying the number of pulses should not exceed the number of pulses.
Copy Function		Set the program number (0-999) of the program parameter that needs to be copied, click the Copy button, a pop-up box will prompt for confirmation, and the reset program copy function will be completed after confirmation.
Pulse Period Jump		Clicking the Pulse Period Data Setting button will jump to the Pulse Setting page (refer to the Pulse Setting page for details).
Custom Data Tags		Five custom fields are used to hold user-defined information. Each customization can save up to 50 English letters or numbers.
Displacement Delay Switch		Enabling this switch Displacement Delay Switch field allows the user to set the Displacement Delay Time clock to extend the measurement time even after current or force end conditions have been met. This allows the Hi5 to record the change in displacement during the cooling of the weld.
Displacement Delay Time		The Displacement Delay Time defines the additional recording time after the current or force end condition is met. The additional time can be set from 0 – 2000 msec. The Displacement Delay switch must be ON to use.

Table 33: Edit Program Settings Fields Overview

4.3.1 Pulse Settings

It is no longer sufficient to weld with a single weld pulse with the materials today. Many complex materials such as Advanced High Strength Steels and coated materials, require multiple weld pulses to pre-heat the material or temper it after the weld.

The Hi5 Weld Monitor can measure multiple weld pulses. The Weld Program must be configured for pulses on the **PROGRAM SETTINGS** page. Then the settings for each pulse are defined on the Pulse Settings page.

The Pulse Settings page allows the user to define the start and end of each pulse in terms of time. The Start and End variables are critical because they define the time period for which the Hi5 measured signals are calculated.

The Pulse Setting screen can be quickly accessed from the Program Settings page. The steps to navigate to the page are shown below in Table 34.

Step	Icon	Description
1	MEASURE SETUP	Starting at the Monitor page, select the MEASURE SETUP icon from the Footer Menu bar.
2	PROGRAM PARAMS	Select the PROGRAM PARAMS icon from the Footer Menu Bar to enter the Program Setting page.
3	PULSE PERIOD DATA SETTINGS	Tap the Pulse Period Data Settings icon to enter the pulse settings.

Table 34: Steps to Navigate to the Pulse Program Settings

Figure 21 shows the Pulse Settings page.

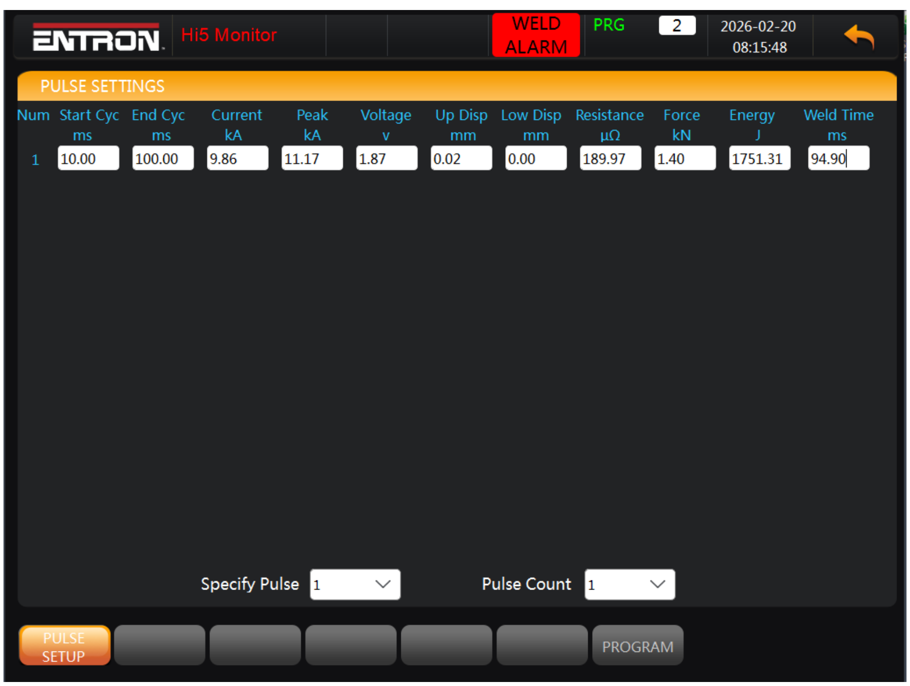
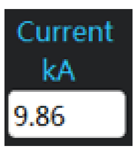
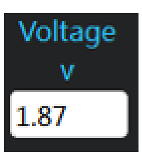


Figure 21: Pulse Settings Screen

The parameters that can be set on the Pulse Settings page are defined in Table 35.

Parameter	Icon	Description	Units
Start Cylce		Sets the start time for when the Hi5 begins measuring data for the corresponding pulse number. The size of the interval used to process the pulse data. For example, if the welding time is 100ms, the start cycle is 10ms, and the end cycle is 80ms, the data in the interval from 10ms to 80ms will be processed and analyzed. Measurement type is in ms for DC and CD welding. When the measurement type is AC, the unit is cyc.	Milliseconds (ms) or cycles
End Cycle		Sets the end time for when the Hi5 stops measuring data for the corresponding pulse number.	Milliseconds (ms) or cycles
Current Target		Sets the target current value of the pulse. When the current alarm is enabled, the Hi5 will set an alarm when the defined limits around this value are violated during the corresponding weld pulse.	Kiloamps (KA)
Peak Current Target		Sets the target peak current value of the pulse. When the current alarm is enabled, the Hi5 will set an alarm when the defined limits around this value are violated during the corresponding weld pulse.	Kiloamps (KA)
Voltage Target		Sets the target voltage value of the pulse When the voltage alarm is enabled, the Hi5 will set an alarm when the defined limits around this value are violated during the corresponding weld pulse.	Volts (V)
Upper Displacement Target		Sets the target upper displacement target of the pulse (post-weld displacement). When the displacement alarm is enabled, the Hi5 will set an alarm when the defined limits around this value are violated during the corresponding weld pulse.	Millimeters (mm)

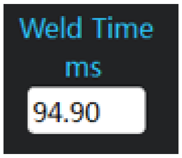
Lower (down) Displacement Target		Sets the target lower (down) displacement target value of the pulse (post-weld displacement). When the displacement alarm is enabled, the Hi5 will set an alarm when the defined limits around this value are violated during the corresponding weld pulse.	Millimeters (mm)
Resistance Target		Sets the target resistance value of the pulse. When the resistance alarm is enabled, the Hi5 will set an alarm when the defined limits around this value are violated during the corresponding weld pulse.	Microohms (μΩ)
Force Target		Sets the target force value for the pulse. When the force alarm is enabled, the Hi5 will set an alarm when the defined limits around this value are violated during the corresponding weld pulse.	
Weld Time Target		Sets the target weld time for the pulse. When the weld time alarm is enabled, the Hi5 will set an alarm when the defined limits around this value are violated during the corresponding weld pulse.	Milliseconds (ms) for DC welding Cycles (cyc) for AC welding
Pulse Count		**Valid only when the pulse mode is multi-pulse.** The number of pulses ranges from (1-10).	Integer
Specify Weld Pulse		**Valid only when the pulse mode is the specified pulse.** Specify the number of pulses in the range (1-10). Specifies that the number of pulses will not exceed the number of pulses.	Integer

Table 35: Pulse Settings Field Overview

To limit the amount of data entry, a synchronization function has been developed to quickly populate the pulse limits with data from an ideal weld. The instructions for populating the Pulse Settings page using the Sync function are in Table 36.

Step	Icon	Description
1		Navigate to the Monitor page and measure a weld.
2		Make a weld to collect the data.

2	HOLD DISPLAY	Put the Monitor in Hold Display Mode.
3	PULSE DATA	Select the PULSE DATA icon to view the Pulse Data for the weld
4	Data Sync To Program 0	Enter the Program number that you want to populate the current data to the Pulse Settings.
5	SYNC	Click the SYNC icon to push the collected data to the Pulse Settings for the selected program

Table 36: Pulse Sync Function to Populate Pulse Settings

4.4 Alarms

One of the key functions of the Hi5 Weld Monitor is to alert the operator or weld engineer when the limits defined for the weld program have been violated. These alarms notify the user that the weld may be out of specification.

The Alarm Program allows the user to configure the alarms to meet your specifications.

The user can:

- Enable alarms for each measured signal or Master Switch
- Set individual upper and lower limits for the signal in terms of percent of the target value
- Define the number of accumulated violations of the limit during the weld

The Alarm Program screen can be quickly accessed from the Program Settings page. The steps to navigate to the page are shown below in Table 37.

Step	Icon	Description
1	MONITOR	Start
2	MEASURE SETUP	Starting at the Monitor page, select the MEASURE SETUP icon from the Footer Menu bar.
3	PROGRAM PARAMS	Select the PROGRAM PARAMS icon from the Footer Menu Bar to enter the Edit Program Settings page.
4	ALARM PROGRAM	Select the ALARM PROGRAM icon to enter the Edit Alarm Program Monitor Settings page.

Table 37: Steps to Navigate to the Alarm Program Page

Figure 22 shows the Edit Alarm Program Monitor Settings page.

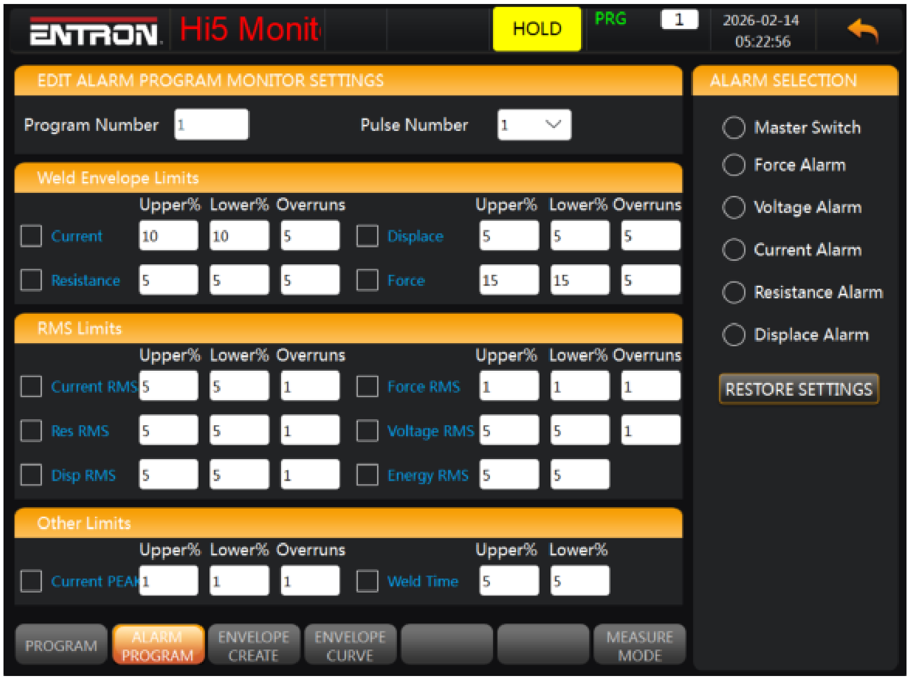


Figure 22: Alarm Program Screen

The Hi5 Weld Monitor Alarm Programming settings may appear complex. However, the alarms are designed to be flexible so you can configure your weld process and set alarms on the signals that are most critical to your application.

The alarms can be set based on a value exceeding a physical value or based on the RMS or average value over the weld pulse.

- **Envelope Limits** are based on the individual measurement being outside the upper and lower limit of the weld. Alarms can be defined for Current, Displacement, Force, Resistance and Voltage.

- **RMS Limits over Time Period** are limits based on the measured RMS or averaged values during the weld pulse. These can be set for the average values of current, resistance, displacement, voltage, energy, force and even peak current.

The Hi5 Weld Monitor structure is divided into three levels of alarm switches as shown in Figure 23. The first level is the master alarm switch. This can be set when any of the sublevel alarms have been set. The second level is the force, current, voltage, resistance, displacement, and weld time alarm switches. The third level is the branch of the second level (rms and envelope alarms). Lower-level switches are only allowed to be set when higher level switches are enabled. For example, you cannot set the Force RMS alarm unless the Master Switch and Force alarms have been enabled.

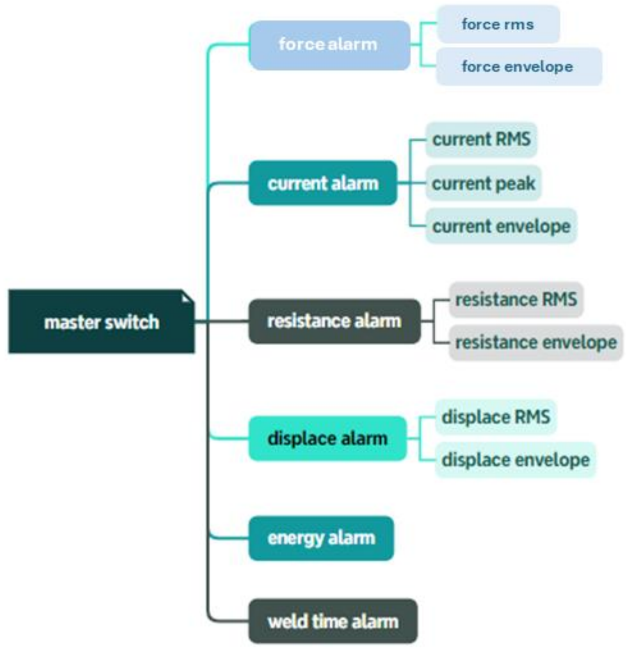
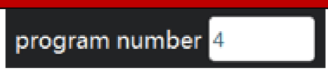
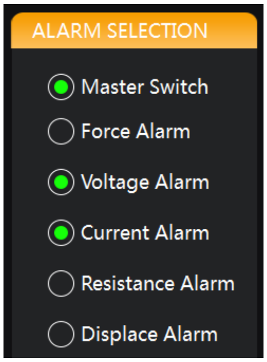
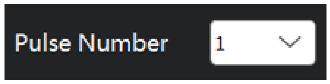
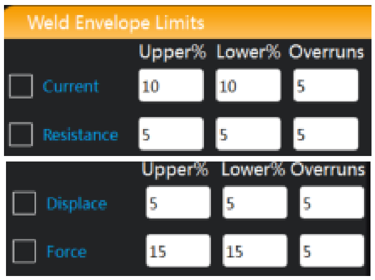
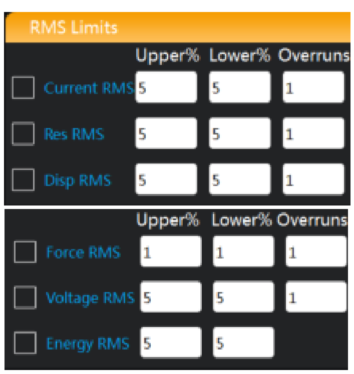


Figure 23: Hi5 Weld Monitor Alarm Topography

Table 38 defines all the variables and parameters that can be set in the Alarm Program page.

Setting	Icon	Description
Program Number		The Program Number defines the weld program that the alarm settings apply to.
Alarm Selection switches (On/Off)		The Alarm Switch section allows the user to enable alarms. Refer the Alarm Topography in Figure 23 before setting. The **Master Switch** must be enabled to enable force, voltage, displacement and current alarms. Tap the circle to enable and disable each Alarm. If the **Master Switch** is not enabled, no alarms will be active.
Restore Settigns		By tapping the  icon, the parameters will be set to default numbers with an Upper% of 5 on all parameters. The Lower% will be set to 5% on all parameters. The overruns will be set to 10 for current, displacement, force, and resistance envelope. All other overruns will be set to 5.

		See Figure 24 for an example of the default settings.
Pulse Number		**Only valid when the Pulse Mode is set to Multi in the Program Settings.** When the pulse mode is multi-pulse, it is allowed to set the upper and lower envelope % and upper and lower limit % separately for multiple pulses.
Envelope Upper & Lower Monitor Limits		Upper Envelope limit % sets the percentage upward offset of the upper envelope curve data, and each pulse is allowed to be set individually. Lower Envelope limit % sets the percentage downward offset of the lower envelope curve data, and each pulse is allowed to be set individually. Overruns: The number of non-consecutive welds where a measured value has exceeded the upper and lower Weld Envelope limits. For pulsed welds, the counter will only increase by one even if multiple pulses exceed the limit during the weld. Once the overrun count limit is exceeded after a weld, the alarm will be set.
RMS Value Limits		Upper and lower limit % is the percentage by which the target value is offset up or down, and can be set individually for each pulse. The target value is set in the pulse setting page. Overruns: The number of non-consecutive welds where a measured value has exceeded the upper and lower RMS limits. For pulsed welds, the counter will only increase by one even if multiple pulses exceed the limit during the weld. Once the overrun count limit is exceeded after a weld, the alarm will be set. Example: If the number of times the limit is exceeded is set to 1, an alarm is generated when a single measurement data exceeds the limit. When the number of overruns is 2, it takes 2 measurements for the data to exceed the limit before an alarm is generated. The alarm is generated when the 1st measurement data exceeds the limit, the 2nd measurement data does not

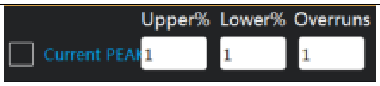
		exceed the limit, and the 3rd measurement data exceeds the limit.
Weld Time		The upper and lower limits for weld time based on a percentage of the target value. The weld time can be defined in the Pulse Setup page
Peak Current		The upper and lower percentage limits on the peak current. Overruns: The number of non-consecutive welds where a measured value has exceeded the upper and lower Current Peak limits. For pulsed welds, the counter will only increase by one even if multiple pulses exceed the limit during the weld. Once the overrun count limit is exceeded after a weld, the alarm will be set.

Table 38: Alarm Program Monitor Settings Field Overview

Figure 24 shows the Alarm Settings after the user clicks the  icon.

Figure 24: Alarm Program Monitor Setting Values After Restore Settings Function

Security Required to Restore Alarm Settings
If user security settings are enabled, the user may be prompted to enter a password to run the Restore Settings function.

4.4.1 Output Alarms

When an Alarm is active the Hi5 Monitor is designed to output a 24V signal from the Digital Outputs. This can be used to light a light or notify another device that an alarm is present. The X3-2 Pin for the digital outputs will output 24V. Refer to the **Wiring Diagram** section for additional information.

4.5 Displacement Calibration for Weld Program

The Displacement Calibration page is used to set the upper and lower displacement reference value for each weld program. The reference value is the position at the start of the weld. The displacement is measured from this reference point.

The Displacement Calibration screen can be quickly accessed from the System Setup page. The steps to navigate to the page are shown below in Table 39.

Step	Icon	Description
1	MONITOR	Starting at the Monitor page, select the SYSTEM SETUP icon from the Footer Menu bar.
2	SYSTEM SETUP	Select the CALIBRATE icon from the Footer Menu Bar to enter the Program Setting page
3	CALIBRATE	Select the DISPLACE icon from the Footer Menu Bar to enter the Displacement Calibration page.
4	DISPLACE	Select the DISPLACE icon to enter the Displacement Calibration screen.

Table 39: Navigation Instructions to the Displacement Calibration Page

Figure 25 shows the Displacement Calibration page.

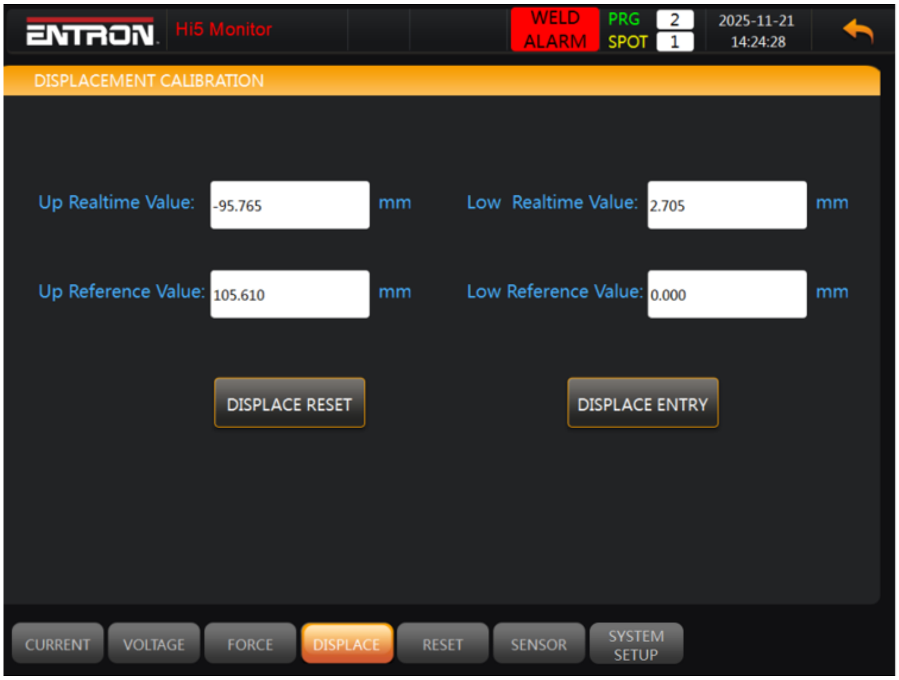


Figure 25: Displacement Calibration Screen for Weld Programs

The parameters for the Displacement Calibration screen are defined in Table 40.

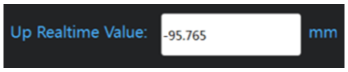
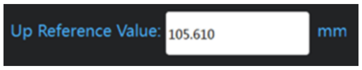
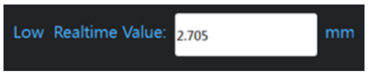
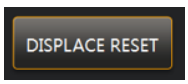
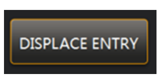
Setting	Icon	Description
Upper Displacement Realtime Value		Real-time value: Indicates the real-time value of the displacement when the displacement home position has been set on the upper electrode.
Upper Displacement Reference Value		Reference value: the displacement value of the workpiece to reach the correct position on the upper electrode.
Lower Displacement Realtime Value		Real-time value: Indicates the real-time value of the displacement when the displacement home position has been set on the lower electrode.
Lower Displacement Reference Value		Reference value: the displacement value of the workpiece to reach the correct position on the lower electrode.
Displacement Reset		Displacement zero operation: the real time value of up and down displacement is cleared to 0 and set as the displacement home position.
Displacement Entry		A displacement zeroing operation is required before displacement entry. When the workpiece to be welded has been fixed in the proper position and under the starting weld force, press the displacement entry button and the real-time value will be saved and updated to the reference value.

Table 40: Displacement Calibration Field Overview

4.6 Envelope Generation

The Envelope Generation is an integral part of the program parameters. The Envelope Curves define the upper and lower limits based of the signal profile. The Hi5 Weld Monitor has a dynamic teach function that allows you to make a series of welds and utilize the data to define the Weld Envelope. Bad welds can be quickly removed to ensure the envelope created for is signal is based on the acceptable welds.

The Envelope Curve can be created for all five weld signals monitored.

- Current
- Resistance
- Force
- Upper Displacement
- Lower Displacement

> **Resistance Unavaible with AC and CD Welding**
> The resistance curve is not available with AC and CD welding. It is only available with DC welding.

The Envelope Generation screen can be quickly accessed from the Program Settings page. The steps to navigate to the page are shown below in Table 41.

Step	Icon	Description
1	MONITOR	Starting at the Monitor page, select the SET UP icon from the Footer Menu bar.
2	MEASURE SETUP	Select the MEASURE SETUP icon from the Footer Menu Bar to enter the Program Setting page.
3	PROGRAM PARAMS	Select the PROGRAM PARAMS icon to enter the Teach Envelope screen.
4	ENVELOPE CREATE	TEACH ENVELOPE page.

Table 41: Navigation Instructions to Envelope Generation Page

Figure 26 shows the Envelope Generation screen.

Figure 26: Envelope Generation Screen for Weld Program

The parameters and buttons on the Envelope Generation page are defined in Table 42.

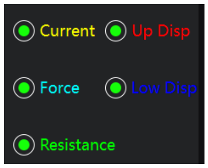
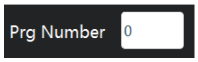
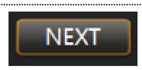
Setting / Button	Icon	Description
Enable/Disable Signals		By clicking the radial button, you can enable and disable the signal to generate the envelope curve for. Enabled signals have a green circle  Disabled signals have a black circle 
Program Number		This defines the Weld Program that the Envelope Curves will be generated for.
Start Welding		The **Start Welding** button initiates the Envelope Generation process for the current weld program. You can use up to 10 welds to generate the envelope
Previous		The **Previous** button allows you to see the previous curve in the Teach Envelope window
Next		The **Next** button allows you to see the next curve in the Teach Envelope window
Delete Selected Curve		The **Delete Selected Curve** button allows you to delete the selected curve from the dataset used to generate the Weld Envelope
Delete All Curves		The **Delete All Curves** button deletes all the curves in the envelope generation window. This allows you to quickly restart the teach process.
Generate Envelope		Clicking the **Generate Envelope** button after enabling will generate an envelope curve for the current program number. If you need to view the details of the envelope curve, please go to the Envelope Curve page or Waveform Analysis page.

Table 42: Envelope Create Page Field Overview

4.6.1 Envelop Curve Generation Instructions

The Envelope Curve Generation is a key feature of the Hi5 Monitor. It allows you to make a series of good welds and use the signature of the good welds to define the weld envelope for the weld program.

The Envelope Curve Generation process is a teach function. The user can make up to 10 welds and use the weld data collected to generate the envelope curves. The user selects which envelope(s) to teach. Then the user can view the weld data and decide to remove any weld from the data set. At the end, the user will generate the curve for the selected monitored signal.

Step by step instructions for generating the weld envelope are defined in Table 43.

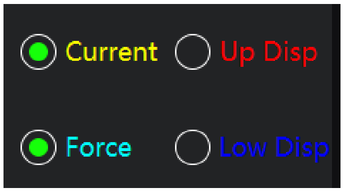
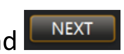
Step	Icon	Description
1		Click the weld signal(s) that you want to generate the envelope for. You can pick one or many. Enabled signals have a green circle  Disabled signals have a black circle 
2		Click the  button to initiate the recording process of up to 10 welds.
3		The Prg field in the Real Time Status menu at the top matches the Program Num.
4		Make up to 10 welds on your machine. After each weld, review the signature of the weld.
5		Delete the welds that are not ideal by clicking the  button. To step through the welds using the  and  buttons.
6		Click the  button to STOP the teach process.
7		After stopping the teach process, the **Generate Envelope** button will be enabled. Click  to generate the Envelope Curve(s) for the selected signals.
8		To view the envelope curve created, click the  button to navigate to the Envelope Curve page that has zoom capabilities to analyze the Envelope Curve.

Table 43: Envelope Curve Generation Instructions

4.7 Envelope Curve

This page is used to display the Envelope Curve of the selected program number. If there is no envelope curve for the selected program number, you will be informed that the envelope curve does not exist when you enter the page.

The Envelope Curve page allows you to analyze the Envelope. The screen has the same zoom features of the Waveform Analysis page. You can zoom into the Envelopes to analyze the curves in detail.

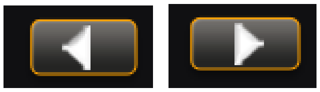
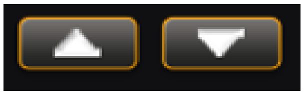
In addition, there is a function to delete the envelope curve.

The Envelope Curve screen can be quickly accessed from the Program Settings page. The steps to navigate to the page are shown below in Table 44.

Step	Icon	Description
1	MONITOR	Starting at the Monitor page, select the MEASURE SETUP icon from the Footer Menu bar.
2	PROGRAM PARAMS	Select the PROGRAM PARAMS icon from the Footer Menu Bar to enter the Program Setting page
3	ENVELOPE CURVE	Select the ENVELOPE CURVE icon to enter the Envelope Curve screen

Table 44: Navigation Instructions to the Envelope Curve Page

The settings and buttons for the Envelope Generation screen are outlined in Table 45.

Setting / Button	Icon	Description
Enable/Disable Signal	Current / Up Disp	The two states show a curve and hide curve respectively.
Delete Curve	DELETE CURVE	Tap the **Delete Curve** button to delete the current program of the envelope curve. When there is no envelope curve, the button is disabled.
Signal Selection Drop Down Menu	Selection: Current	Tap on the drop-down box to select the curve to be manipulated.
Left Right Navigation Arrows		Use the Left and Right icons to shift the graphic left or right along the time axis.
Up Down Navigation Arrows		Use the Up and Down icons to shift the graphic up or down along the y-axis.

Zoom		The user can zoom in and out by using the buttons on the zoom icon. The Auto button can be used to automatically adjust the x and y axis to fit the data set. **Y-axis zoom-in operation:** Y+ **Y-axis zoom-out operation:** Y- **X-axis scaling:** X- and X+ **Auto adjusts x and y axis:** Auto

Table 45: Envelope Curve Page Field Overview

4.8 Name Program Overview

The Name Overview screen shows the name-based setup of the workpiece and program names. This screen can be checked to confirm the programs and workpieces are correctly linked to your internal part number and identifiers.

The name-based values are set in the

PROCESS SETTINGS and **PROGRAM SETTINGS** sections.

The Name Overview screen can be quickly accessed from the Program Settings page. The steps to navigate to the page are shown below in Table 46.

Step	Icon	Description
1	MONITOR	Starting at the Monitor page, select the MEASURE SETUP icon from the Footer Menu bar.
2	MEASURE SETUP	Select the NAMEVIEW icon from the Footer Menu Bar to enter the Name View page.
3	NAMEVIEW	All programmed Workpiece and Program Names can be viewed.

Table 46: Navigation Instructions to the Nameview Page

Figure 27 shows the Name Overview screen.

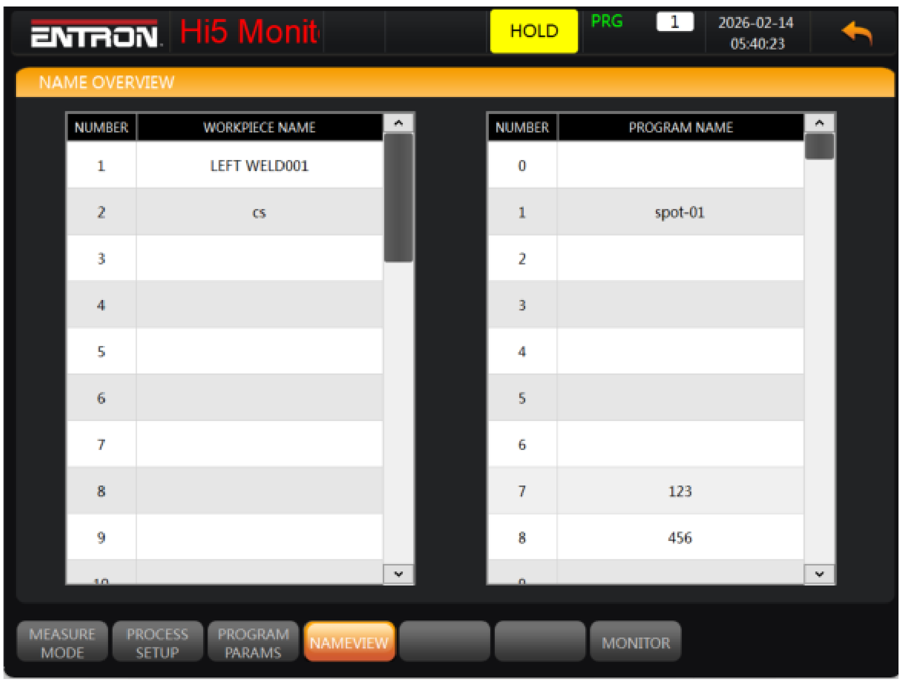


Figure 27: Name Overview Screen for Weld Programs

5 DATA MANAGEMENT

The Hi5 Weld Monitor's large data storage capacity allows the user to store many welds. The plot of each weld can be viewed and analyzed on the Hi5 Weld Monitor. The recorded weld data can also be exported for offline additional analysis.

5.1 Data Record Page

The Data Record page allows the user to view the historical weld information in a table format. The table provides a summary of each weld recorded. The user can view the plot of each weld and an also classify each weld as "ok" or "not ok".

To navigate to the Data Record page, the user should select Monitor Mode and tap the icon. 

Figure 28: Footer Navigation Menu Bar in Measure Mode to Access the Date Record Page

Figure 29 shows an example of the Data Record screen.

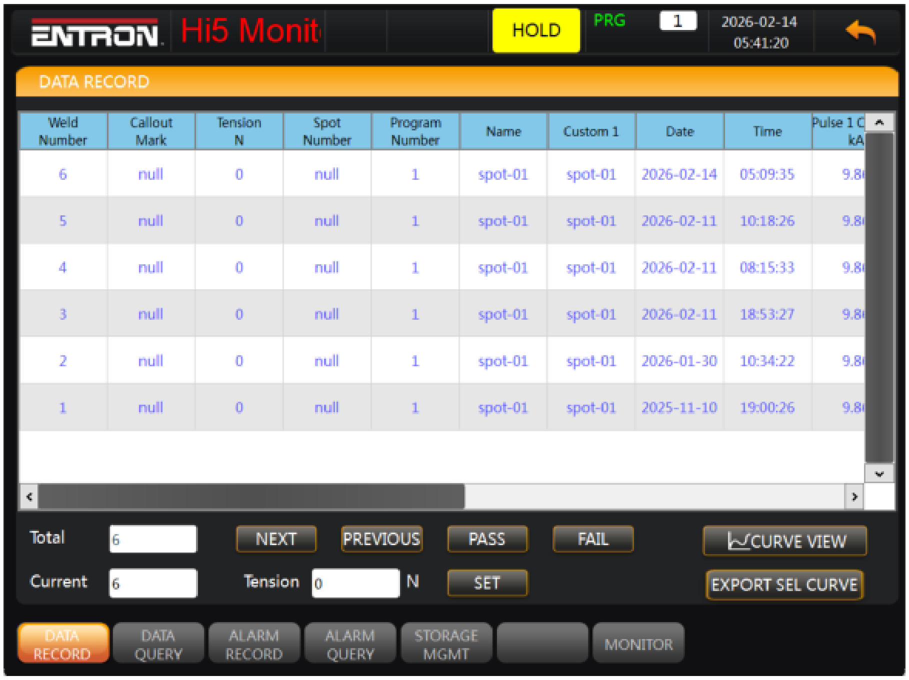


Figure 29: Hi5 Weld Monitor Data Record Screen

Table 47 provides an overview of each icon on the Data Record screen.

Setting / Button	Icon	Description
Total Welds	Total 11	Displays the total number of weld records stored in the Hi5 Weld Monitor
Current Weld	Current 11	Displays the current weld record selected in the data record table. The user can tap the Current Weld and edit the number to jump to the desired ID
Previous	PREVIOUS	Tap the PREVIOUS button to select previous weld record
Next	NEXT	Tap the NEXT button to select next weld record
Curve View	CURVE VIEW	Tap the CURVE VIEW button to view the plot of the weld shown in Current Weld field.
Ok	OK	Tap OK to classify the current weld as a **good weld**.
Not Ok	NOK	Tap NOK to classify the current weld as a **bad weld**
Export Curve	EXPORT SEL CURVE	Click the EXPORT SEL CURVE to export the current weld.

Table 47: Data Record Page Field Overview

5.1.1 Curve Waveform Page

The Curve Waveform page is like the **WAVEFORM ANALYSIS PAGE**. The Curve Waveform allows you to view and analyze the plot of the current weld.

To navigate to the Curve Waveform page from the Data Record page, tap the CURVE VIEW button.

5.1.2 Curve Pulse Data Page

The Curve Pulse page is similar to the **PULSE DATA PAGE**. This allows the user to view the Curve Pulse Data for the current weld in table format.

To navigate to the Curve Pulse Data page from the Curve Waveform page, the user should tap the CURVE PULSE icon in the footer.

Figure 30: Footer Navigation Menu Bar in Hold Mode with Pulse Data Page Selected

5.1.3 Curve Periodic Data Page

The Curve Data page is similar to the **PERIODIC DATA PAGE** in Section 2.5.7. This allows the user to view the Curve Data for the current weld in table format. The value for each millisecond of the weld is shown.

To navigate to the Periodic Data page from the Curve Waveform page, the user should tap the 

icon.

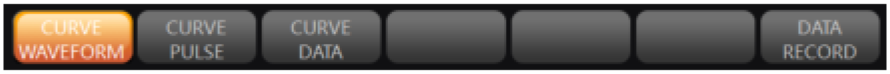


Figure 31: Footer Navigation Menu Bar in Hold Mode with Period Curve Data Page Selected

5.2 Data Query Page

The Data Query page enables the user to filter the weld data based on selected criteria. The data can be filtered by date, program, serial number (i.e. record number), or custom (i.e. program name or work piece name). The selected data can then be exported.

To navigate to the Data Query page from the Data Record page, the user should tap the 

icon in the footer.

Figure 32: Data Query Page Selected in the Footer Menu

Figure 33 shows Data Query page.

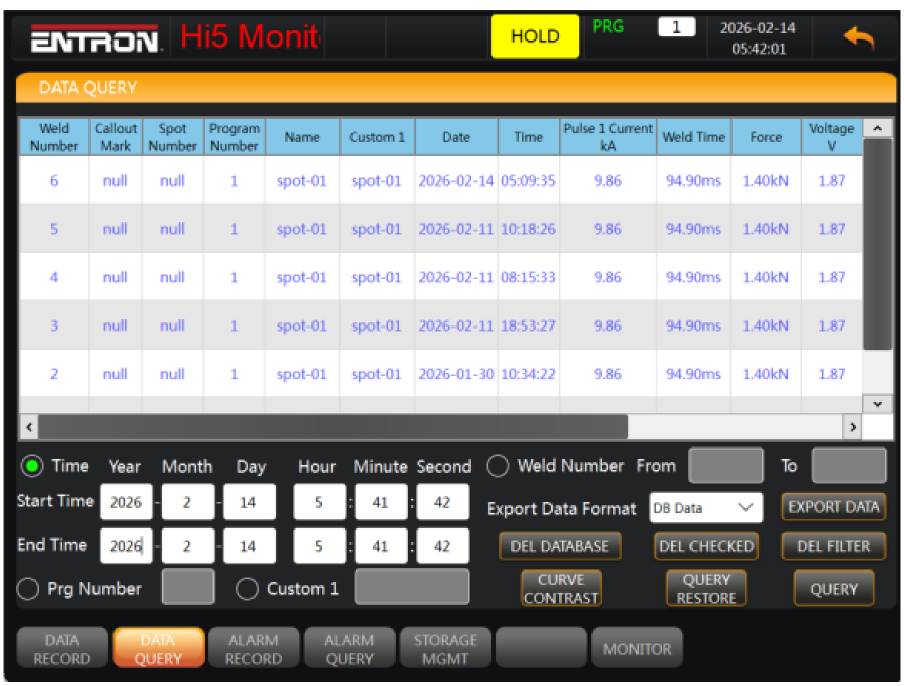


Figure 33: Data Query Screen

Table 48 provides an overview of the buttons and fields on the Data Query page.

Setting / Button	Icon	Description
Export Data	EXPORT DATA	This icon exports the queried data in Excel format to a USB flash drive. If no query has been performed, all the data will be exported
Export Data Format	Export Data Format [DB Data]	This drop down allows the user to select the format of the data export. The options are: • **DB Data** – is a summary of each weld (e.g., I_{peak} and I_{RMS}). The file format is ***.db*** • **Curve Data** – is the data for each of the weld curves. The file format is ***.csv*** • **All Data** – is an export of both the DB Data and Curve Data files.
Deleted Checked Weld	DEL CHECKED	This icon deletes the data of the selected rows. The delete operation requires the supervisor to enter the password to confirm
Delete Filtered Data	DEL FILTER	This icon deletes the queried or filtered data. The delete operation requires the supervisor to enter the password to confirm
Delete Database	DEL DATABASE	This icon deletes all data from the Hi5 weld monitor. The delete operation requires the supervisor to enter the password to confirm
Time Filter	Time — Year, Month, Day, Hour, Minute, Second Start Time 2025 - 11 - 24 10 : 12 : 12 End Time 2025 - 11 - 24 10 : 12 : 12	When the [Time] filter checkbox is selected, the data can be queried by the start date time to end date time.
Weld Number	Weld Number From [0] To [0]	When the [Weld Number] filter checkbox is selected, the data can be

		filtered by the Weld numbers of the weld based on the range input.
Program Filter	Prg Number 0	When the Prg Number filter checkbox is selected, the data can be filtered by the selected Program number.
Custom Filter	Custom 1	When the Custom 1 filter checkbox is selected, the data can be filtered by the Custom Names defined in the PROGRAM SETTINGS.
Query	QUERY	The QUERY button performs the query based on the filter type selected and filter inputs.
Query Restore	QUERY RESTORE	The QUERY RESTORE button resets the query settings to the default.

Table 48: Data Query Page Field Overview

5.3 Alarm Query Page

The Alarm Query page allows the user to filter the weld data based on selected criteria. The data can be filtered by date, program, serial number (i.e. record number), or custom (i.e. program name or work piece name). The selected data can then be exported.

To navigate to the Data Query page from the Data Record page, the user should tap the ALARM QUERY icon in the footer.

Figure 34: The Footer Menu in Data Record Management

Figure 35 shows the Alarm Query page.

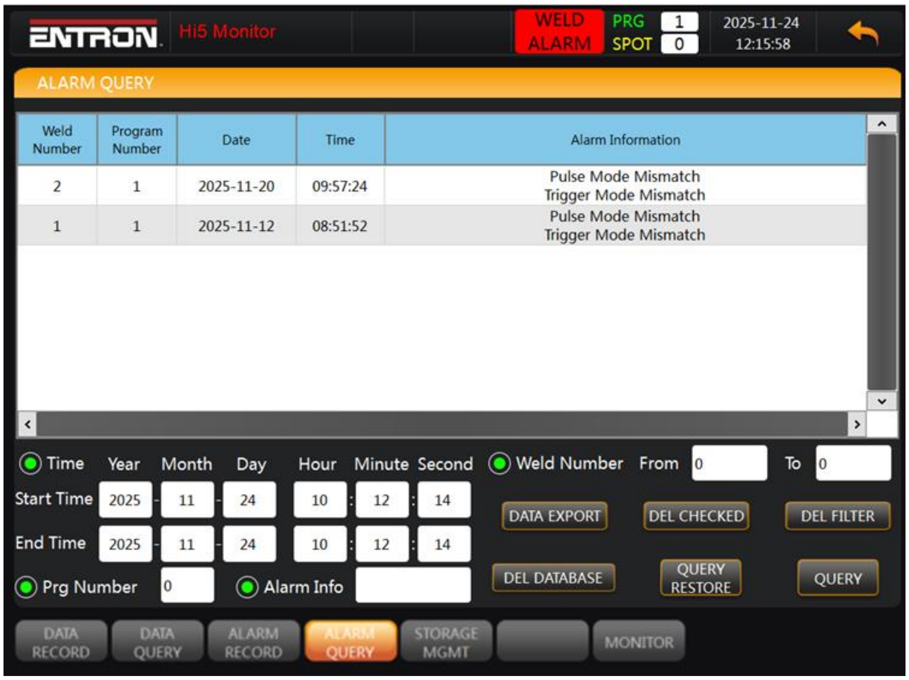


Figure 35: Alarm Query Page

Table 49 provides an overview of the buttons and fields on the Alarm Query page.

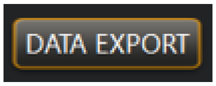
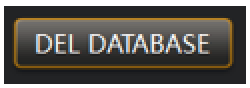
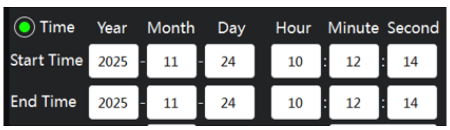
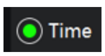
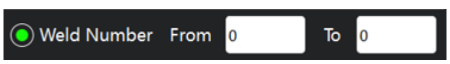
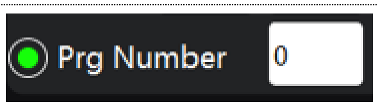
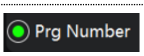
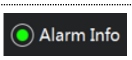
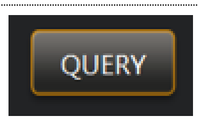
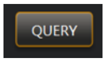
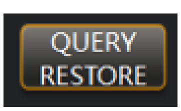
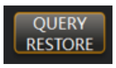
Setting / Button	Icon	Description
Export Data		This button exports the queried data in Excel format to a USB flash drive. If no query has been performed, all the data will be exported
Deleted Checked Weld		This icon deletes the data of the selected rows. The delete operation requires the supervisor to enter the password to confirm
Delete Filtered Data		This icon deletes the queried or filtered data. The delete operation requires the supervisor to enter the password to confirm
Delete Database		This icon deletes all data from the Hi5 weld monitor. The delete operation requires the supervisor to enter the password to confirm
Time Filter		When the  filter checkbox is selected, the data can be queried by the start date time and end date time.
Serial Filter		When the  filter checkbox is selected, the data can be filtered by the weld numbers of the weld based on the range input.
Program Filter		When the  filter checkbox is selected, the data can be filtered by the Program number.
Alarm Filter		When the  filter checkbox is selected, the data can be filtered by the Alarm Information defined on the **ALARM QUERY** page.
Query		The  icon performs the query based on the filter type selected and filter inputs.
Query Restore		The  icon resets the query settings to the default.

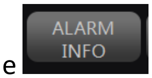
Table 49: Alarm Query Page Field Overview

5.4 Alarm Information Page

The Alarm Information page displays detailed information about the alarm. The timestamp, program number and summary of the alarm are displayed.

The Alarm Information page can be navigated to in Monitor Mode.

1) From Monitor Mode

To navigate to the Alarm Information page in Monitor Mode, tap the 

icon in the footer. This will show the alarm information of the current weld.

Figure 36: Footer in Monitor Mode with the Alarm Information Page selected

The user will be notified that an Alarm has been Measured by displaying the 

icon in the header.

Figure 37: Header in Measure Mode with Alarm Notification

The Weld Alarm Information page is shown in Figure 38.

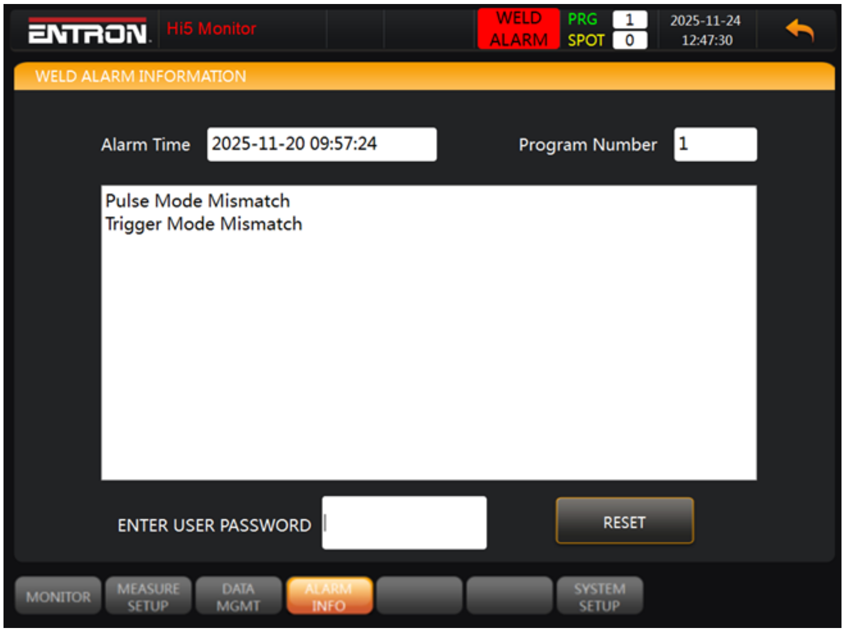
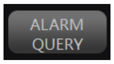


Figure 38: Alarm Info Page

2) From Data Record Management

To navigate to the Alarm Record Information page in Data Record Management, tap the 

icon in the footer. This will show the alarm information from the current weld.

Figure 39: Footer in Data Management with the Alarm Record page Selected

The Alarm Information page is shown in Figure 40.

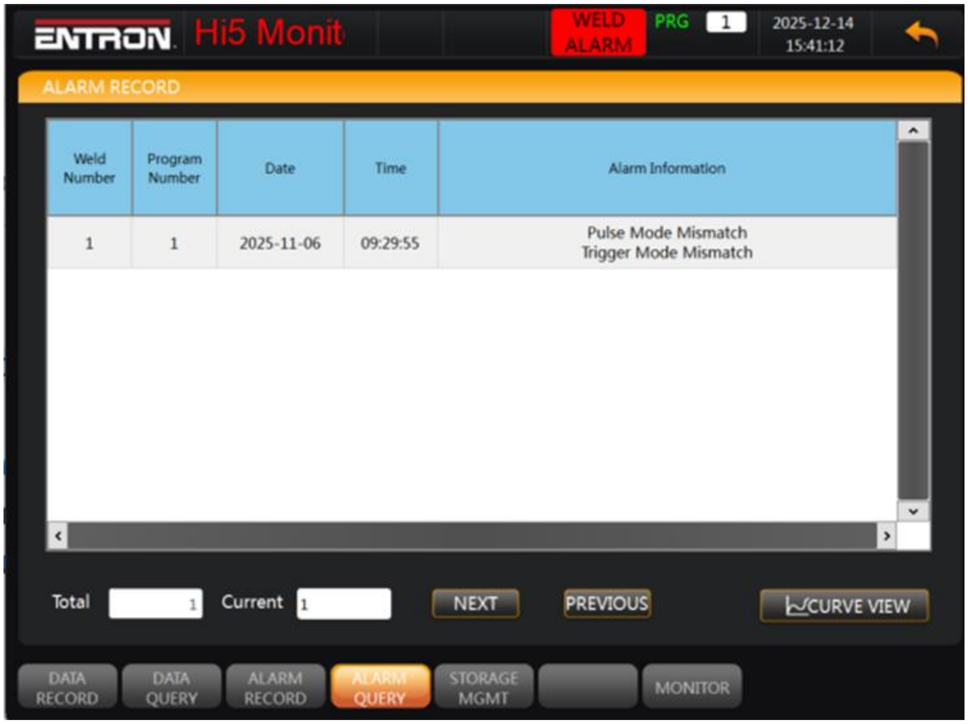


Figure 40: Alarm Record Information Screen

Table 50 provides an overview of the fields and buttons on the Alarm Information page.

Setting / Button	Icon	Description
Total	Total 1	Displays the total alarm count
Alarm Time	Current 1	Displays the current selected alarm from the list
Next	NEXT	Tapping **Next** toggles to the next weld with an Alarm in the list
Previous	PREVIOUS	Tapping **Previous** toggles to the previous weld with an Alarm in the list
Curve View	CURVE VIEW	Tapping the **Curve View** button opens the graphical view of the selected weld with the alarm.

Table 50: Alarm Record Page Field Overview

5.5 Storage Management

The Hi5 Monitor is designed with a SD card slot to allow users to expand the storage capacity of the device. The Storage Management page allows users to perform the following data storage related functions:

- Clear Database
- Delete the Curve File
- Export DB to Udisk
- Format SD Card

To Navigate to the Storage Management page from the Monitor page, tap **DATA LOG** in the footer menu. Then tap **STORAGE MGMT** in the footer menu.

A summary of each of the functions can be found in Table 51.

Setting / Button	Icon	Description
Clear Database	Clear Database CONFIRM	Tap the confirm button to clear the database. A popup box will require you to confirm before executing.
Delete Curve File	Del Curve File CONFIRM	Tap the confirm button to clear the weld curve data (i.e weld recordings). A popup box will require you to confirm before executing.
Export DB to Udisk	Export DB To Udisk CONFIRM	Tap the confirm button to export all of the data to a Udisk or USB drive. A popup box will require you to confirm before executing. **DO NOT PERFORM ANY OPERATIONS UNTIL EXPORT IS COMPLETE.**
Format SD Card	Format SD Card CONFIRM	The SD slot on the Hi5 Weld Monitor allows you to increase the memory size of the device. **After installing a new SD card, it must be formatted.** Press the Confirm icon, a prompt box will pop up, confirm again before formatting the SD card. The confirmation button will change to a grey color during the formatting process confirm. After the process is complete, the confirm icon will return to its original state.

Table 51: Storage Management Function Overview

6 SYSTEM MANAGEMENT

The System Management menus contain the administration options and configuration of the Hi5 Weld Monitor. The following menus allow the user to view the software version, define languages, setup users and passwords.

To navigate to the System Management menus from the Monitor Mode, tap the 

icon.

Figure 41: Footer Menu in Measure Mode

6.1 System Manager Page

The System Manager page is for the administrator, and it contains the system level settings and passwords for user types. The Hi5 Weld Monitor supports both raw data collection and the ISO 17657 data collection standard for measuring resistance welding signals.

To Navigate to the specific settings page, tap the desired icon in the footer once you have entered System Management.

Figure 42: Footer Menu in System Management with System Manager Screen Selected

Figure 43 shows the System Manager page.

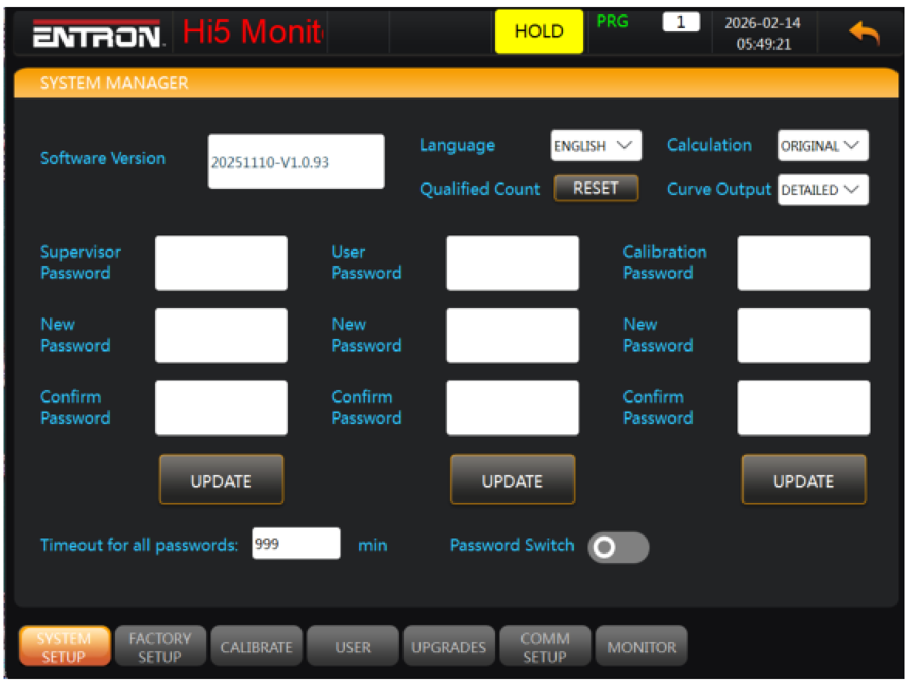
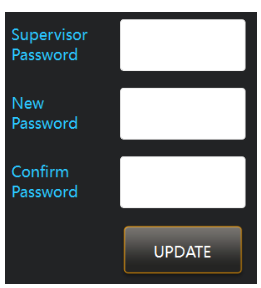
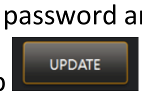


Figure 43: System Manager Screen

Table 52 defines the icons and fields in the System Manager page.

Setting / Button	Icon	Description
Software Version		This displays the current software version of the Hi5 Weld Monitor
Language		The Language drop down menu allows the user to select the language of the device (English or Chinese)
Calculation		The Calculation drop down menu defines the data collection method. The options are raw (ORIGINAL) or ISO17657.
Curve Output		The Curve Output selection defines the sampling rate and data file size for each weld. 1. **SIMPLE** – is the **recommended** mode. The Hi5 Monitor will sample and store data points for each millisecond of the recording. 2. **DETAILED** – is a higher resolution sampling. 100 data points will be recorded for each millisecond. This gives higher resolution of the weld data. However, the data files are approximately 100 times larger.
Supervisor Password		The Supervisor (i.e. administrator) password is the highest-level administrator password. To change the password, enter the existing password and new password; then tap 

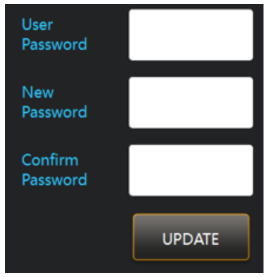
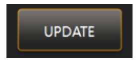
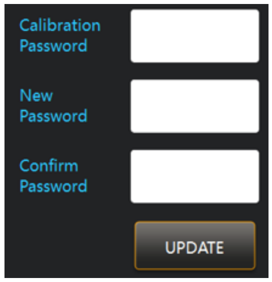
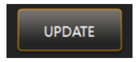
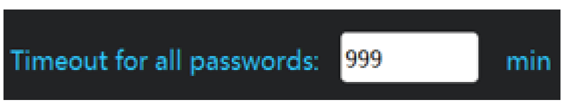
User Password		The User password is for users. To change the password, enter the existing password and new password; then tap 
Calibration Password		The Calibration password is for Calibration rights. To change the password, enter the existing password and new password; then tap 
Password Switch		The Password Switch is a toggle switch that allows the user to enable and disable the Security Requirements for the device. When the Password switch is disabled (i.e. greyed out), user and supervisor passwords are not required for the device
Password Timeout		The Password Timeout field defines the password clock in units of minutes. After entering the user or supervisor password, the password will not be required for the specified amount of time.

Table 52: System Manager Page Field Overview

6.1.1 User Roles and Passwords

The Hi5 Monitor is designed to give the users flexibility in defining the password policies for the device. There are three user types that can have passwords defined in the device as show in Table 53.

User Type	Description
Supervisor	The Supervisor Password is required for entering the Process, Program, and System Setup menus.

	The Supervisor Password is also required for clearing Supervisor Level Alarms.
User	The User Password is defined for a machine operator. The User Password is only required to clear User Level Alarms.
Calibration	The Calibration Password is required to enter the Calibration Menus to calibrate the device

Table 53: Users Roles with Passwords

The menu topography with the password requirements is shown in Figure 44. This provides a visual representation of the User Role passwords required to enter the various menus.

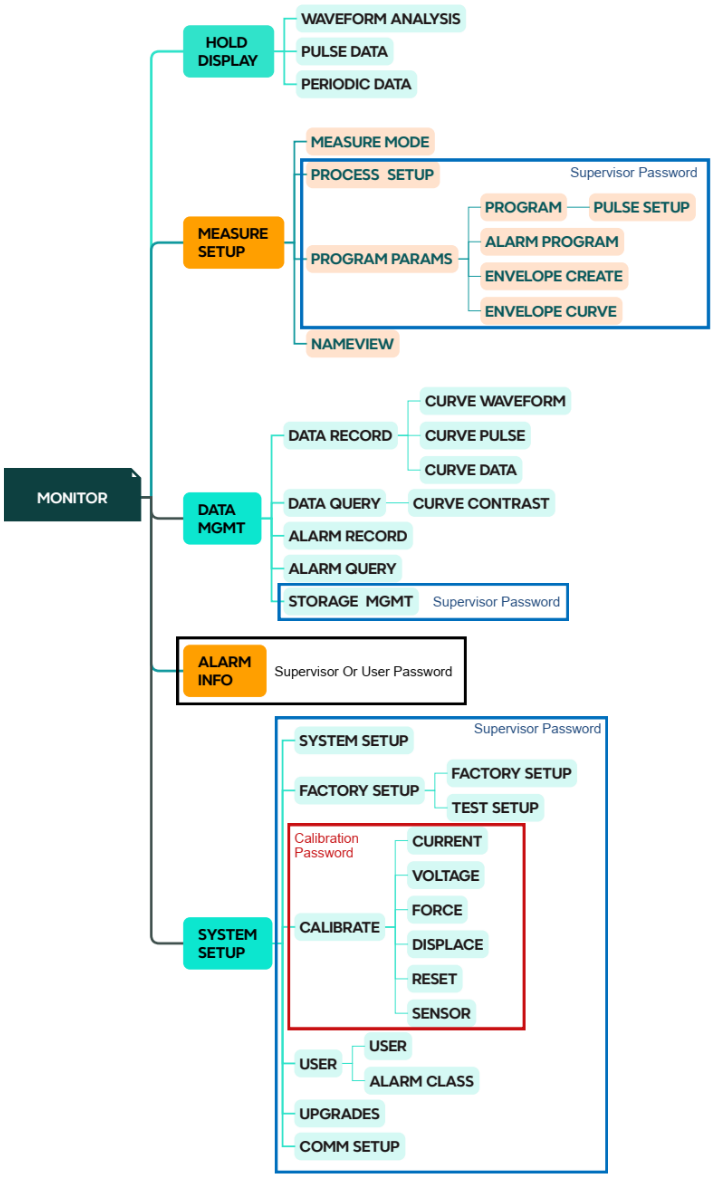


Figure 44: Menu Topography with Password Requirements Defined

6.1.2 Default Password

The Hi5 Monitor is supplied with a default password for the Supervisor, User, and Calibration Roles as shown in Table 54.

User Type	Default Password
Supervisor	369369
User	111111
Calibration	159357

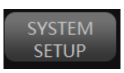
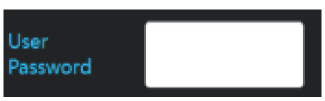
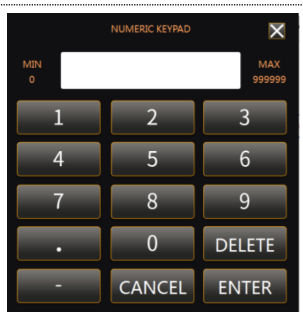
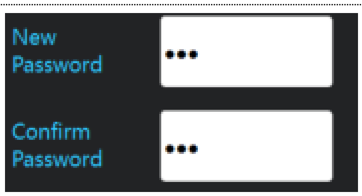
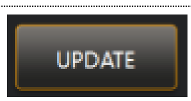
Table 54: Default Passwords for Roles

6.1.3 Factory Password

The Factory Password is reserved for the manufacturer. This menu is not accessible to users.

6.1.4 Instructions To Update a Password

The instructions to update the password for one of the three roles is defined in Table 55.

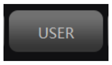
Step	Icon / Action	Description
1		Tap the Return Arrow icon in the Header menu to go the Measure mode screen.
2		Tap the **SYSTEM SETUP** button in the footer menu. Type in the Supervisor Password to the pop-up window. After tapping OK, the screen will change to SYSTEM MANAGER.
3		In this example, we will update the **User Password**. Tap the textbox next to the **User Password**.
4		Type the password in the popup keypad and tap enter.
5		Enter the new User Password in the New and Confirm fields. A popup with keypad will appear. Enter the password and tap enter.
6		Tap **UPDATE**

7		The Operation Successful popup will appear.
8		Verify the Password Switch is ENABLED (i.e. green)

Table 55: Instructions to Update Password for a Role

6.2 User Settings Page

The Users Settings page allows the user to define the brightness, screensaver time, and the clock.

To Navigate to the Display Settings page, tap the 

icon in the footer once you have entered System Management.

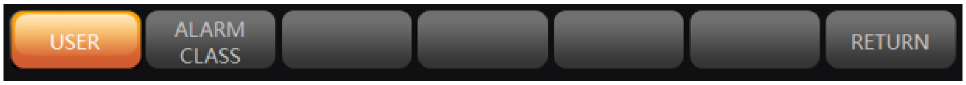


Figure 45: Footer Menu in System Management with User Settings Screen Selected

Figure 46 shows the User Settings page and Table 56 defines all the buttons and fields on the page.

Figure 46: User Settings Page

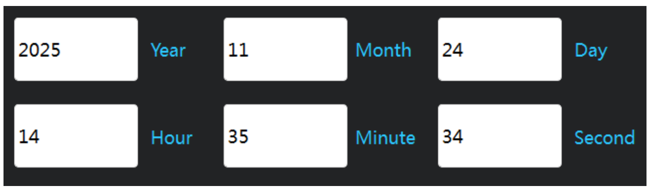
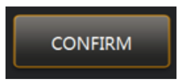
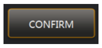
Setting / Button	**Icon**	**Description**
Brightness Level		The screen brightness level has five levels (2-7), and is usually set to either 6 or 7.
Screensaver Time		Screensaver time is the timer for how long the screen will remain on without any user activity. The settable time range is (10-999999) minutes.
Clock Settings		The Clock Settings field can be updated to set the year, month, day, hour, minutes, and seconds.
Confirm Clock		Click the  icon to update the Clock Settings.

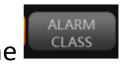
Table 56: Display & Date - Time Settings Field Overview

6.3 Alarm Classification

The Alarm Classification page shows all the alarm types of the device. You can configure the Alarms int two levels:

1. USER (i.e. User) Level
2. SUPERVISOR (i.e. Supervisor) Level

The classification defines which password is required to clear the Alarm. Therefore, critical alarms that require intervention form an engineer or manager can only be cleared by the SUPERVISOR. This prevents operators from continuing to run after a major alarm has occurred.

To navigate to the Alarm Classification page from the Users page, select the 

icon in the footer menu. The User page is selected in the System menus.

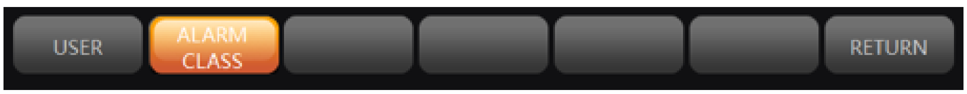


Figure 47: Footer Menu in System Management with Alarm Class Settings Screen Selected

Figure 48 shows the Alarm Classification screen.

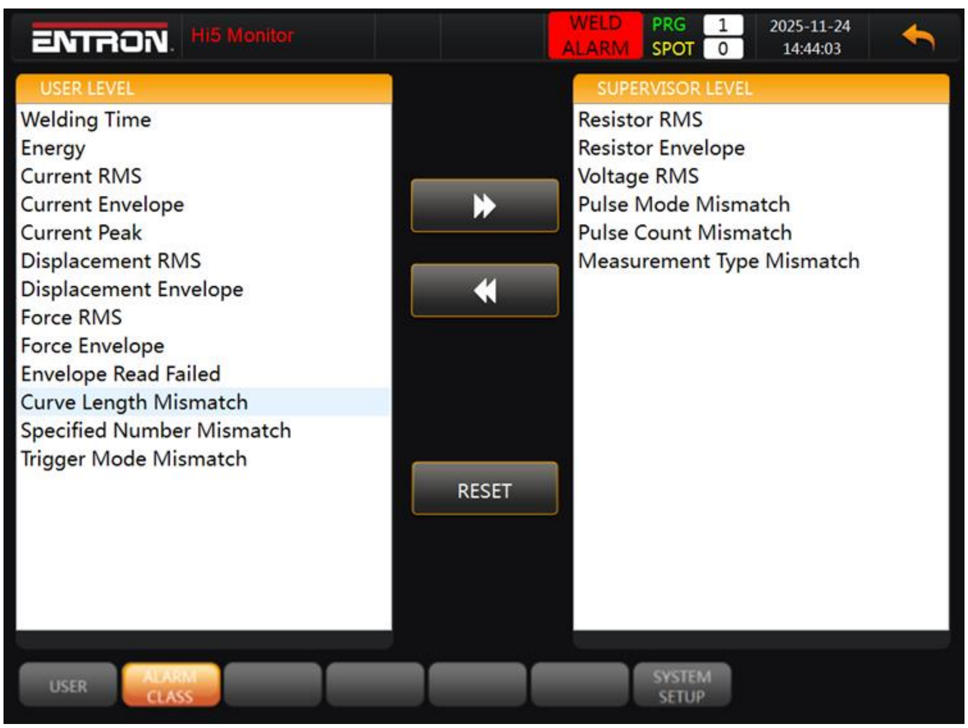


Figure 48: Alarm Classification Screen

Table 57 shows define the buttons on the Alarm Classification page.

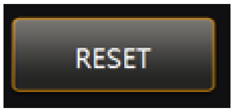
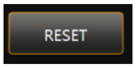
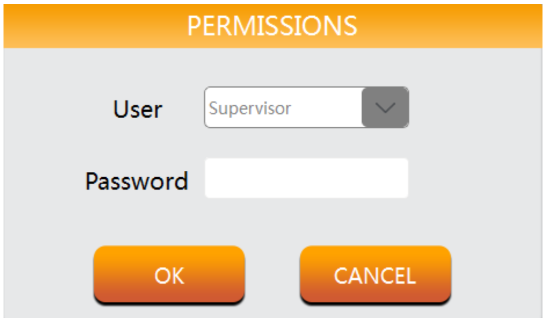
Setting / Button	Icon	Description
Move Right		Tap the Alarm to move, then select the right arrow to move the Alarm to the Manager Level classification.
Move Left		Tap the Alarm to move, then select the right arrow to move the Alarm to the Operator Level classification.
Reset Password		The  button allows the Supervisor to reset passwords for the Manager and Operator in the Alarm Classification page. When this icon is tapped, it brings the Popup menu below to define the password for the Operator (user) and Supervisor (administrator). 

Table 57: Alarm Classification Page Icon Overview

Table 58 defines the Alarms monitored by the Hi5 Monitor. Each Alarm can be classified as a **USER** or **SUPERVISOR** level alarm. The classification defines which the password level required to clear each Alarm.

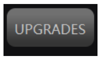
Alarm Name	Description
Welding Time	The welding time upper or lower limit has been violated
Energy	The energy upper or lower limit has been violated
Current RMS	The current RMS upper or lower limit has been violated
Current Envelope	The current envelope upper or lower limit has been violated
Current Peak	The peak current upper or lower limit has been violated
Resistor RMS	The Resistance RMS upper or lower limit has been violated

Resistor Envelope	The Resistance Envelope upper or lower limit has been violated
Voltage RMS	The Voltage RMS upper or lower limit has been violated
Displacement RMS	The Displacement RMS upper or lower limit has been violated
Displacement Envelope	The Displacement Envelope upper or lower limit has been violated
Force Envelope	The Force Envelope upper or lower limit has been violated
Envelope Read Failed	The Envelope Read Failed alarm signifies the weld envelope limits are enabled for the program, but the envelope has not been generated yet. Refer to the **ENVELOPE GENERATION** section for more information
Pulse Mode Mismatch	The Pulse Mode Mismatch alarm signifies a mismatch between the Pulse Mode defined in the Program Settings and the Weld Envelope generated. The user has generated a weld envelope for a "single pulse" weld, but the envelope limits enabled on the program are set to "multi-pulse" or vice versa. Review the program settings to ensure the Pulse Mode is properly set.
Pulse Count Mismatch	The weld pulse count does not match the expected number of weld pulses. Review the Pulse Data Settings for the Weld Program and the selected Weld Program.
Curve Length Mismatch	Not currently in use
Specified Number Mismatch	Not currently in use
Trigger Mode Mismatch	The expected trigger does not match recorded weld. Review the Trigger Mode for the Weld Program (Current or Force) and the selected Weld Program.
Measurement Type Mismatch	The expected measure type does not match recorded weld. Review the Measure Type for the current Program (AC / DC / CD) and the selected Program.

Table 58: Alarm List & Definitions

6.4 Software Upgrade

The Hi5 Weld Monitor is designed to be able to update the operating software in the field using the USB port. This allows software updates and improvements to be loaded onto your device.

To Navigate to the System Setup Manager page, tap the 

icon in the footer once you have entered System Management.

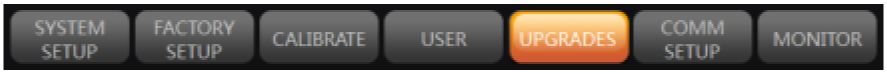


Figure 49: Footer Menu in System Management with Upgrades Screen Selected

The Software Updates screen is shown in Figure 50.

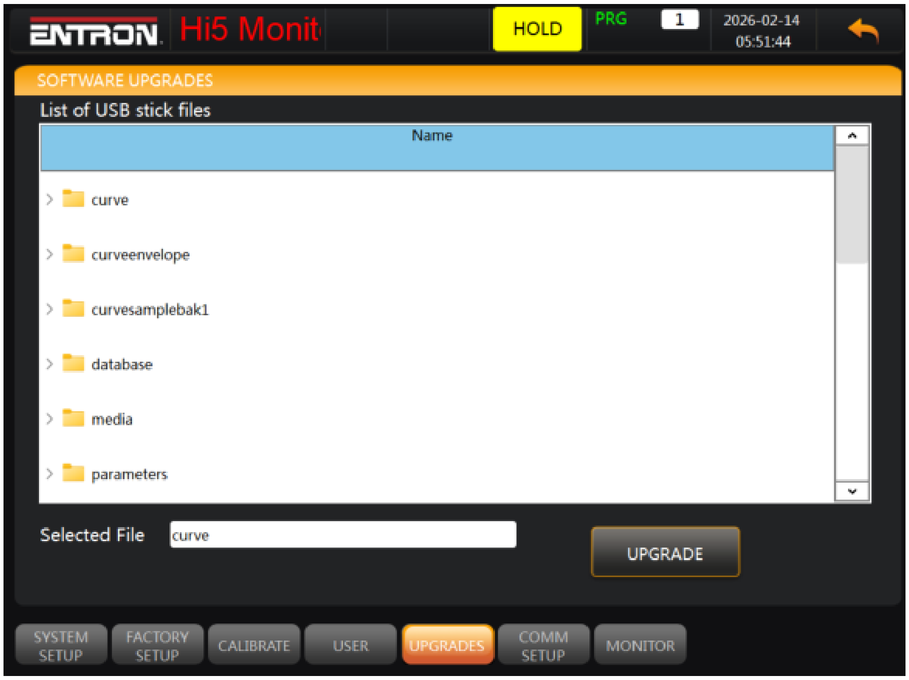


Figure 50: Software Updates Screen

The steps to update the software on the Hi5 Weld Monitor are defined in Table 59.

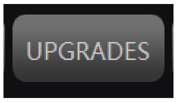
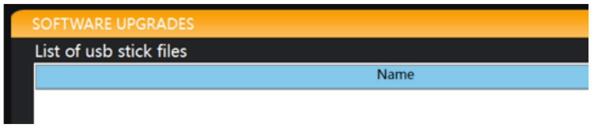
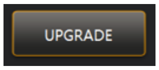
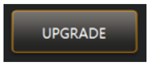
Step	Icon / Action	Description
1		Insert USB drive into the Hi5 Weld Monitor with the hrc650.tar.bz2 software update.
2		Navigate to the Software Updates page by clicking the  icon in the footer menu in System Management.
3		Tap the hrc650.tar.bz2 file to select in the program list.
4		Verify the hrc650.tar.bz2 file is selected.
5		Tap the  icon to update the software.
6	Restart after Confirmation Popup	After the pop up stating the upgrade is complete, restart the Hi5 Weld Monitor **by cycling the power off and on.**

Table 59: Software Update Instructions

6.5 Network Settings

The Hi5 Weld Monitor has the capability to communicate with external devices via ethernet and serial ports. This allows the device to send result of each weld to an external device. When using http communication, the remote server and slave communication switch must be configured.

To Navigate to the Network Settings page, tap the 

icon in the footer once you have entered System Management.

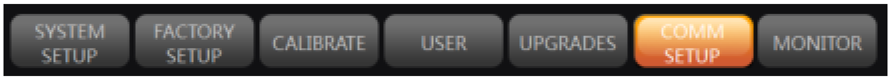


Figure 51: Footer Menu in System Setup with Network (Comms) Settings Screen Selected

Figure 52 shows the Network Settings page.

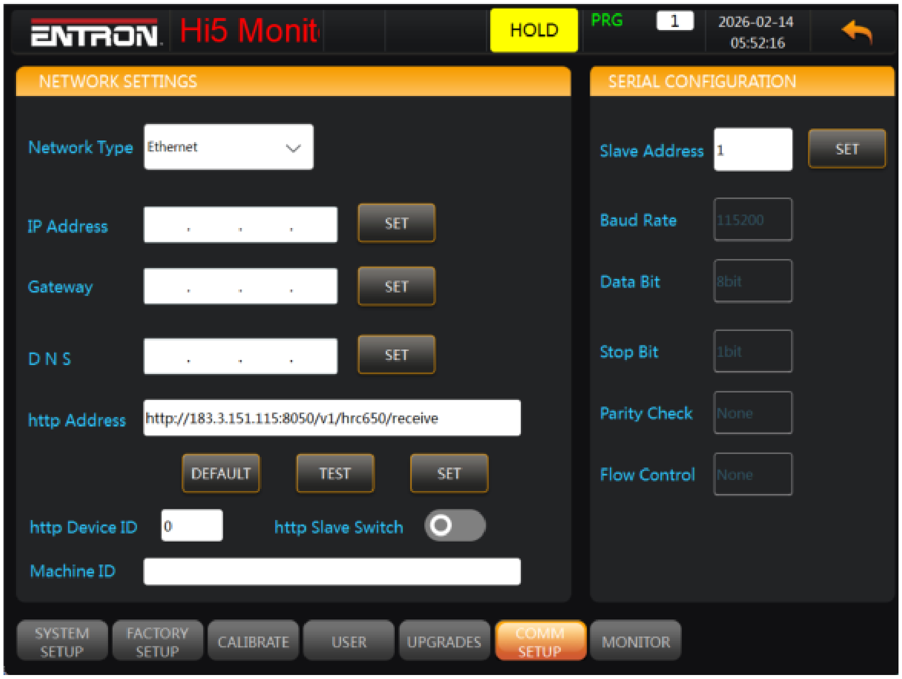
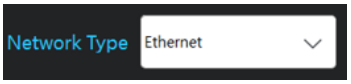
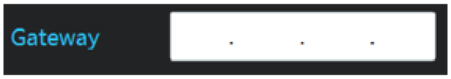
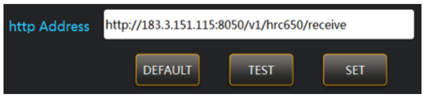


Figure 52: Network Settings Screen

Table 60 provides an overview of the buttons and fields on the Network Settings screen.

Setting / Button	Icon	Description
Network Type		The network type dropdown menu allows the user to select the communication type. The options are RS485, Ethernet or 4G
IP Address		The IP address is required for Ethernet communication and 4G communication. Type the desired value and tap SET to set the IP address.
Gateway		The default gateway can be set for Ethernet communication and 4G communication. This field can be left blank. Type the desired value and tap SET to set the default gateway.
DNS		The DNS can be set for Ethernet communication and 4G communication. This field can be left blank. Type the desired value and tap SET to set the default gateway.
Http Address		The Http Address is the remote Http Server used to receive the POST requests. After entering the Https Address of the target server, click the TEST icon to test the communication is normal. A popup will appear with a message stating the communication is normal or abnormal. Once normal communication has been established, tap the SET icon.
Http Device ID Number		The Http device ID number defines the device number when the Hi5 Weld Monitor is used as an Http slave.

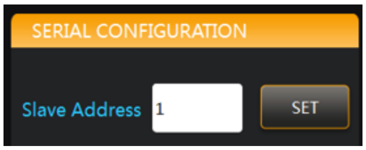
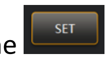
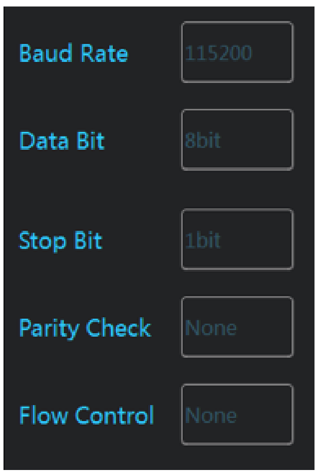
Http Slave Switch		The Http Slave Communication switch enables and disables Http Slave Mode. When the function is enabled, the device will send the weld data to the remote Http server via Http protocol after each weld is complete.
Slave Address		The Slave Address is set for RS485 SERIAL CONFIGURATION. Enter the desired value and tap the  icon.
RS485 Data Settings		The RS485 settings are default and are not editable. These are visible to the user for establishing the communication connection with an external device.

Table 60: Network Settings Page Field Overview

6.6 Factory Settings

The Factory Settings page is for the manufacturer. This page is not accessible by users.

6.7 Sensor Model Settings

In the System Setup menu, the sensors types can be configured. This allows you to set the range of the force sensor, units of measure for force, force sensor type, and the resolution of the displacement sensors. The user can also enable and disable sensors for measurement. If you decide not to measure a certain signal it can be disabled.

To navigate to the Sensor page, you will need the Supervisor and Calibration passwords to access the Sensor Menu. Follow the steps defined in Table 61 to navigate to the Sensor page.

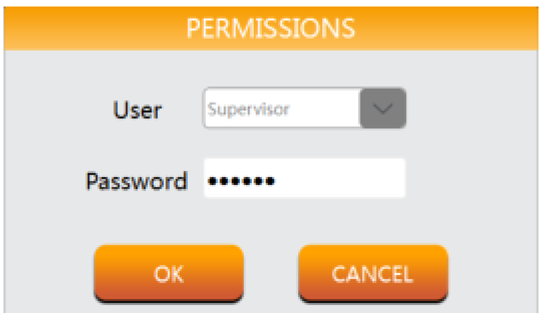
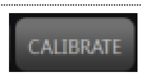
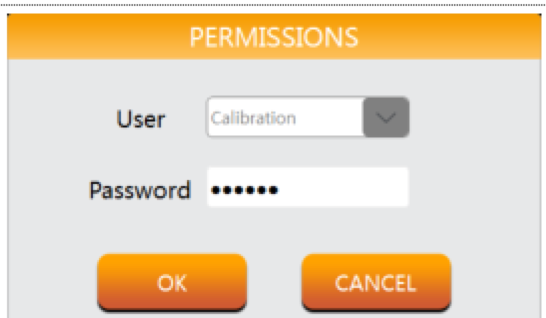
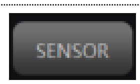
Step	***Icon***	***Description***
1		From the Monitor page, tap the **System Setup** icon in the footer menu.
2		Enter the **Supervisor** password and tap **OK**
3		Tap the **Calibrate** icon in the footer menu
4		Enter the **Calibration** password and tap **OK**
5		Tap the **Sensor** icon in the footer menu

Table 61: Navigation Instructions to Sensor Model Settings Page

Figure 53 shows the Sensor page

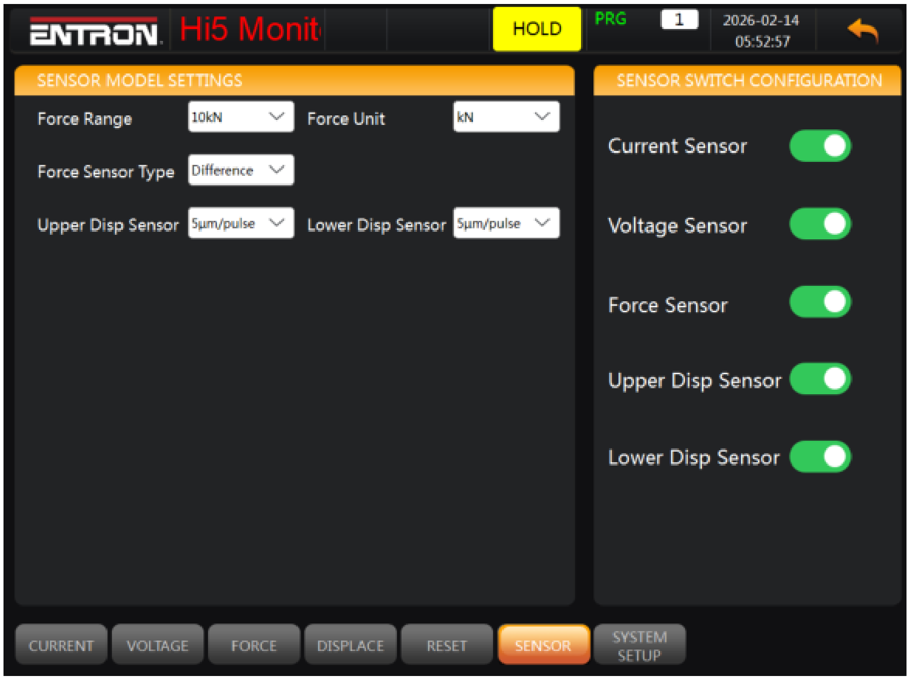
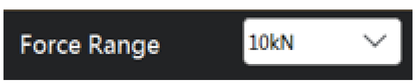
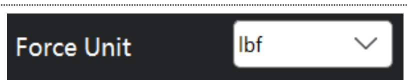
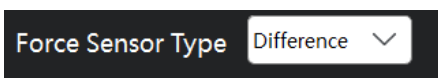
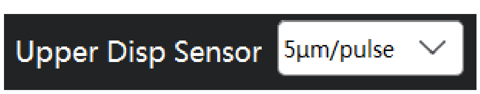


Figure 53: Sensor Screen in Factory Settings

Table 62 provides an overview of the buttons and fields on the Sensor screen.

Setting / Button	***Icon***	***Description***
Force Range kN		The Force Range defines the maximum value of the of the force sensor connected to the Hi5 Weld Monitor. The drop down contains the following options: • 2kN • 10kN • 50kN • 200kN
Force Unit kN		Defines the Unit of Measure for the force measurement. **The options are:** • **kN (Kilonewtons)** • **lbf (Pound-force) see below.** • **kgf (Kilogram-force) see below.**
Force Unit lbf		
Force Range lbf		The Force Range defines the maximum value of the of the force sensor connected to the Hi5 Weld Monitor.

		The drop down contains the following options: • 450 lbf • 2200 lbf • 11000 lbf • 45000 lbf
Force Unit kgf		
Force Range kgf		The Force Range defines the maximum value of the of the force sensor connected to the Hi5 Weld Monitor. The drop down contains the following options: • 200 kgf • 1000 kgf • 5000 kgf • 20000 kgf
Force Sensor Type		The Hi5 Weld Monitor is compatible with two types of force sensors. The options are: • Difference (Differential signal) • Analog The two types of sensors are wired differently. Refer to the **FORCE CONNECTION** for more information.
Upper Displacement Sensor		The Hi5 Weld Monitor supports three types of encoder sensors and analog type displacement sensors. The types of displacement sensors are: • 5µm / pulse • 10µm / pulse • 50µm / pulse • Analog • 2.5µm / pulse • 25µm / pulse **The Analog sensor requires calibration.**

		Note: 1. The analog sensors require both ADC and displacement calibration, while the encoder sensors only require displacement calibration. 2. Since the Hi5 weld monitor uses A and B signals from the encoder sensor, the selected resolution is ¼ of the actual resolution of the sensor. For example, if 5µm/pulse is selected on the Hi5 weld monitor, the encoder sensor is required to have 20 µm/pulse resolution.
Lower Displacement Sensor		The Hi5 Weld Monitor supports five types of encoder sensors and analog type displacement sensors. The types of displacement sensors are: • 5µm / pulse • 10µm / pulse • 50µm / pulse • Analog **The Analog sensor requires calibration.** Note: 1. The analog sensors require both ADC and displacement calibration, while the encoder sensors only require displacement calibration. 2. Since the Hi5 weld monitor uses A and B signals from the encoder sensor, the selected resolution is ¼ of the actual resolution of the sensor. For example, if 5µm/pulse is selected on the Hi5 weld monitor, the encoder sensor is required to have 20 µm/pulse resolution.
Upper Displacement Calibration Count		Requires the **Upper Displacement Sensor** to be set to **Analog**.

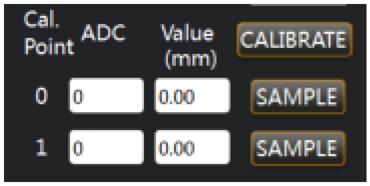
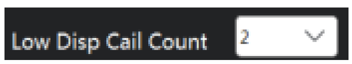
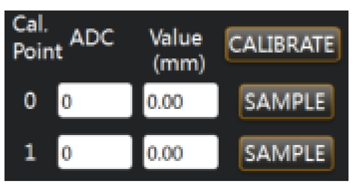
		The Up Disp Cali Count defines the number of rows in the calibration table. The number can range from 2 to 5 points
Upper Displacement Calibration Table		Requires the **Upper Displacement Sensor** to be set to **Analog**. The **ADC** value is read from the displacement sensor when tapping **SAMPLE**. The **Value (mm)** is entered by the user based on the reference displacement sensor reading. See **ANALOG DISPLACEMENT SENSOR CALIBRATION** section for more information.
Lower Displacement Calibration Count		Requires the **Lower Displacement Sensor** to be set to **Analog**. The **Low Disp Cali Count** defines the number of rows in the calibration table. The number can range from 2 to 5 points
Lower Displacement Calibration Table		Requires the **Lower Displacement Sensor** to be set to **Analog**. The **ADC** value is read from the displacement sensor when tapping **SAMPLE**. The **Value (mm)** is entered by the user based on the reference displacement sensor reading. See **ANALOG DISPLACEMENT SENSOR CALIBRATION** section for more information.

Table 62: Sensor Model Settings Page Overview

6.7.1.1 Analog Displacement Sensor

When the Hi5 Monitor is configured to use an analog displacement sensor, the displacement calibration values will appear on the Sensor screen as shown in Figure 54. The Analog Displacement Sensor must be calibrated. The instructions to calibrate the Analog Displacement Sensor can be found in the Analog Displacement Sensor Calibration Section.

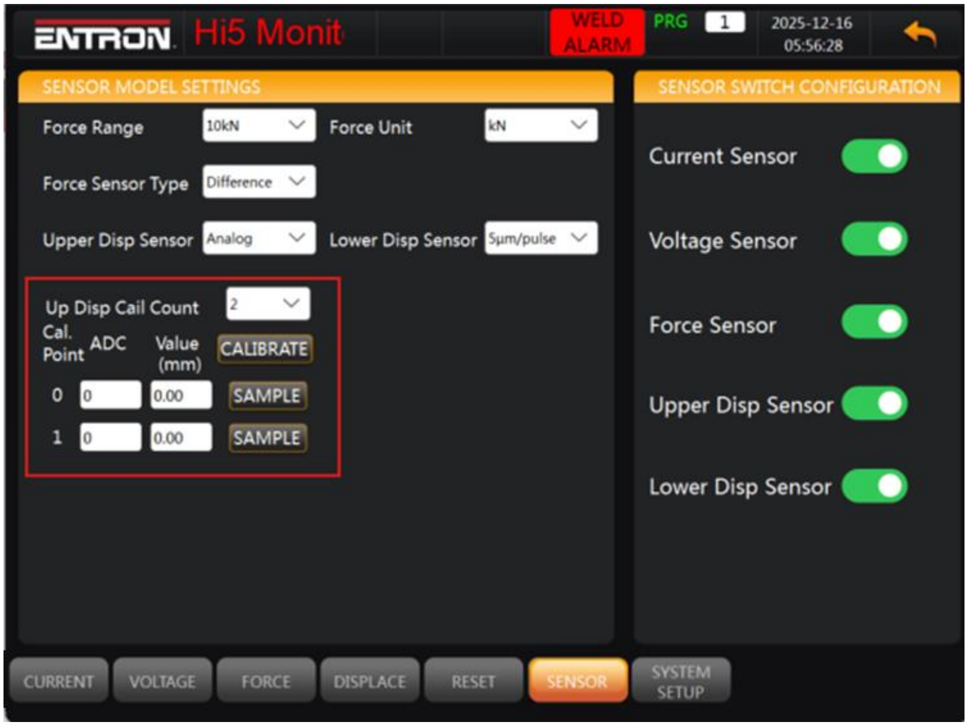


Figure 54: Analog Displacement Calibration Parameters

Analog Displacement Sensor Limited to One
The Hi5 Monitor can only accommodate a single analog displacement sensor. If you need to measure displacement on the upper and lower electrode of the welding machine, you must use an encoder type sensor. See the **WIRING DIAGRAM** for more information.

7 CALIBRATION

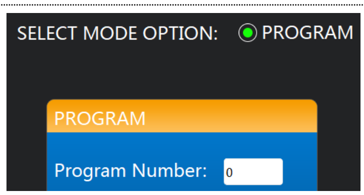
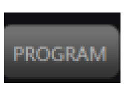
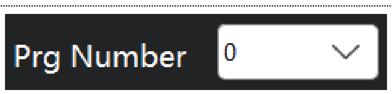
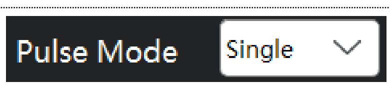
The Hi5 Weld Monitor is designed to be mounted to a specific piece of equipment and utilize an array of sensors to record measurements. Therefore, the unit can be calibrated in the field against external calibration devices to ensure the measurements recorded are accurate.

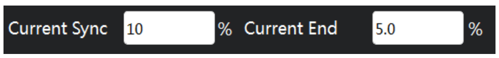
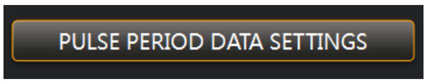
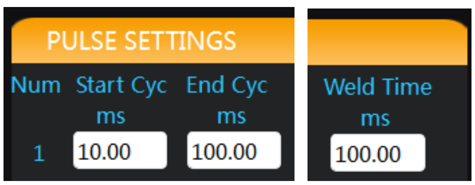
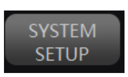
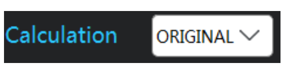
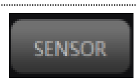
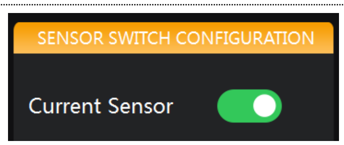
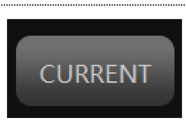
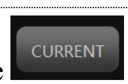
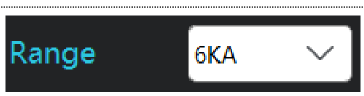
7.1 Current

Weld Current is one of the most critical resistance welding parameters. It is critical that the weld current is calibrated prior to use to ensure accurate measurements.

Calibrate Current Before Use
The Current must be calibrated before using the Hi5 Weld Monitor

The Current Calibration procedure is defined in Table 63. Since the Hi5 Weld Monitor has two calculation modes (i.e., ORIGINAL and ISO17657) and each calculation mode has five ranges (i.e., 6kA, 20kA, 60kA, 200kA, and 1000kA), the ten configurations are individually calibrated by the factory. The Hi5 Meter can also be calibrated by users. On site calibration requires a reference meter.

Step	Icon / Action	Description
1		Tap the Return Arrow icon in the Header menu to go to the Measure mode screen.
2		Tap the SET UP icon on the footer menu to enter the Setup Pages.
3		Choose **PROGRAM** for SELECT MODE OPTION. Next, type in the program number that is going to be used for the Hi5 monitor Current Calibration.
4		In this example program 0 is selected. Tap the **PROGRAM** icon in the footer menu. Then type in the Supervisor Password in the pop-up window. After tapping OK, the screen will change to EDIT PROGRAM SETTINGS.
5		Configure the parameters for current calibration. *See the examples below.*
6		Set the **Program Number** to be identical to that in Step 3.
7		Set the Pulse Mode to Single.

8		Set the measurement type (AC, DC, or CD) based on the machine welding process where the Hi5 Weld Monitor is installed on. **Note: For AC welding, the frequency must be set**
9		Set the Trigger Mode to Current.
10		**Current Sync** and **Current End** should be identical to those on the reference current meter.
11		Tap the  to navigate to the PULSE SETTINGS page.
12		Set the Start Cyc, End Cyc, and Weld Time to be identical to those on the reference meter. **Note:** For consistent calibration results, please ensure the weld control welds at least 100 ms during the calibration process.
13		Tap the **Return Arrow** in the header menu to return to the MEASURE page.
14		Tap the **SYSTEM SETUP** button in the footer menu. Then type in the Supervisor Password to the pop-up window. After tapping OK, the screen will change to SYSTEM MANAGER.
15		Set the Calculation (i.e., ORIGINAL or ISO17657) to be identical to that on the reference meter.
16		Tap the **CALIBRATE** button in the footer menu. Then type in the Calibration Password to the pop-up window. Then, tap OK.
17		Tap the **SENSOR** button in the footer menu.
18		Enable the Current Sensor.
19		Tap the  button in the footer to display the current calibration screen (see Figure 55)
20		Set the calibration range. The available options are: • 6KA

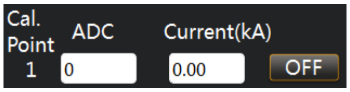
		• 20KA • **60KA** • 200KA • 1000KA **Note:** 1. To ensure accurate calibration, we recommend choosing a calibration range approximating the max weld current. 2. After calibration, the calibrated range will be used by all programs.
21		Set the number of calibration points in the calibration table. **Note:** 1. The calibration points can be chosen between 11 and 32. 2. We recommend dividing the max weld current by the number of calibration points to determine the current increment. For instance, if the max current of the weld control is 11kA and the number of calibration points is 11, the weld current should increase by 1kA per calibration point.
22		Tap **START** to begin the calibration process. The **START** icon will change to **STOP**.
23		The calibration will start in the first row of the calibration table. Tap the **OFF** button to change it to **ON** and then tap the **ACQUIRE** button to capture the ADC value at 0 kA. Next, tap the **ON** button to change it to **OFF**. The first calibration point is finished.
24		Move to the second row of the calibration table. Tap the **OFF** button to change it to **ON.** Next, increase the weld current and fire the weld control. The ADC value at the second row will be automatically updated. Next, type in the reference meter's weld current reading in the corresponding **Current(kA)** textbox. Then tap **ON** to change it to **OFF**. The second calibration point is finished.
25		Repeat Step 24 until the number of calibrated points reaches the value defined in the **CALIBRATE POINTS** field.
26		Tap **STOP** to stop the calibration procedure.

Table 63: Current Calibration Instructions

After the current calibration, the graphical view will show the current calibration for your machine. An example is shown in Figure 55.

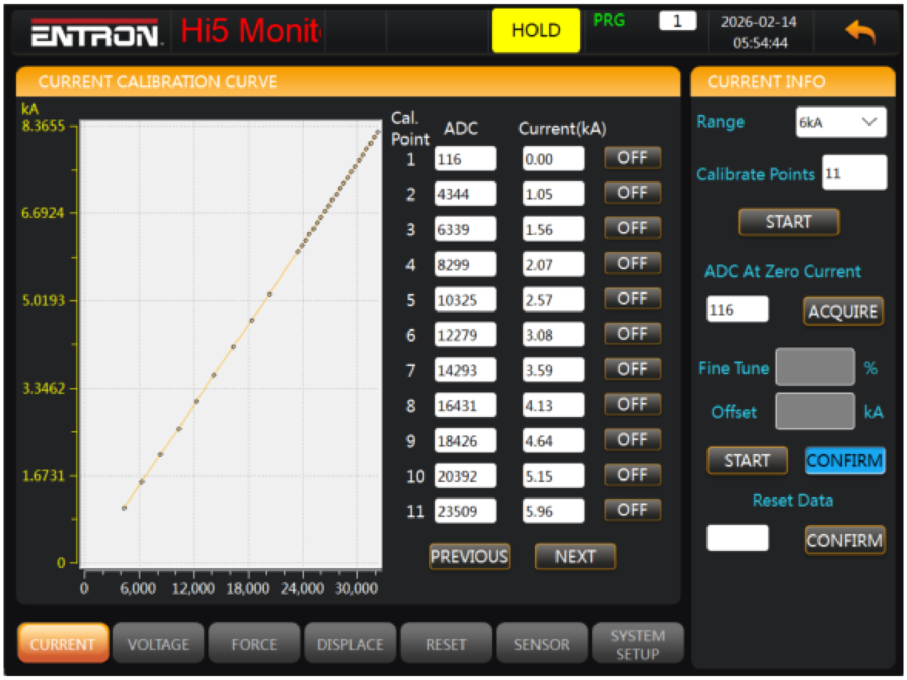


Figure 55: Current Calibration Screen

7.1.1 Reset Current Calibration

The user can reset the Current Calibration settings for the current range (6KA, 20KA, 60KA, 200KA, 1000A) by entering the superuser password in the Reset Data field and tapping CONFIRM.

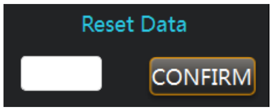
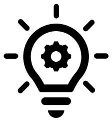


Figure 56: Reset Data in Current Calibration Screen

7.2 Voltage

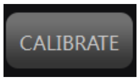
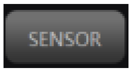
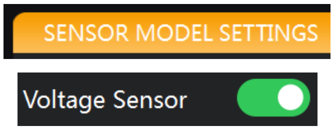
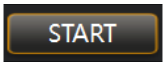
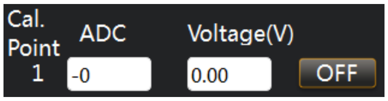
Weld Voltage is one of the most critical resistance welding parameters. It is critical that the weld voltage is calibrated prior to use to ensure accurate measurements.



Calibrate Voltage Before Use
The Voltage must be calibrated before using the Hi5 Weld Monitor

The Voltage Calibration procedure is defined in Table 64. The Hi5 Weld Monitor has two ranges for voltage (20V and 60V). The two ranges should be calibrated separately. During voltage calibration, a DC power supply and a reference voltage meter are required.

Step	Icon / Action	Description

1		Tap the Return Arrow icon in the Header menu to go the Measure mode screen.
2		Tap the **SYSTEM SETUP** button in the footer menu. Type in the Supervisor Password to the pop-up window. After tapping OK, the screen will change to SYSTEM MANAGER.
3		Tap the **CALIBRATE** button in the footer menu. Type in the Calibration Password to the pop-up window. Then, tap OK.
4		Tap the **SENSOR** button in the footer menu.
5		Enable the **VOLTAGE SENSOR**.
6		Tap the **VOLTAGE** button in the footer menu to enter the voltage calibration screen (Please see Figure 57)
7		Set the calibration range. The available options are: • 20V • 60V **Note:** 1. To ensure accurate calibration, we recommend choosing a calibration range approximating the max weld voltage. 2. After calibration, the calibrated range will be used by all programs.
8		Set the number of calibration points. **Note:** 1. The calibration points can be chosen between 2 and 4. 2. We recommend dividing the max weld voltage by the number of calibration points to determine the voltage increment. For instance, if the max voltage of the DC power supply is 20V and the number of calibration points is 4, the DC power supply output voltage should increase by 5V per calibration point.
9		Tap the **START** to begin the calibration process. The **START** will change to **STOP**.
10		The calibration will start at the first row of the calibration table. Tap the **OFF** to change it to **ON**. The ADC value at the first row will be automatically updated. Next, type in the reference voltage meter's reading to the right textbox, and

		then tap the **ON** to change it to **OFF**. The first calibration point is then finished.
11		Move to the second row of the calibration table. Tap the **OFF** to change it to **ON**. Next, increase the DC power supply's output voltage. The ADC value at the second row will be automatically updated. Next, type in the reference voltage meter's reading to the right textbox, and then tap the **ON** to change it to **OFF**. The second calibration point is then finished.
12		Repeat Step 11 until the number of calibrated points reaches the value defined in the **CALIBRATE POINTS** field.
13		Tap **STOP** to stop the calibration procedure.

Table 64: Voltage Calibration Instructions

After the voltage calibration is complete, the graphical view will show the voltage calibration for your machine. An example is shown in Figure 57.

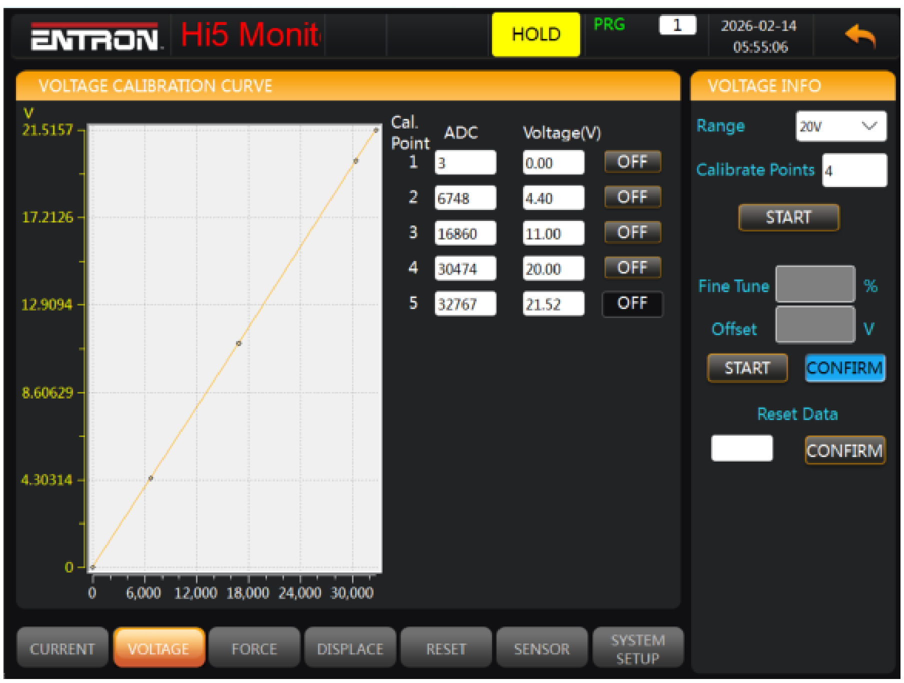


Figure 57: Voltage Calibration Screen

7.2.1 Reset Voltage Calibration

The user can reset the Voltage Calibration settings for the voltage range (20V and 60V) by entering the superuser password in the Reset Data field and tapping CONFIRM.

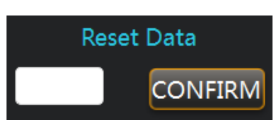


Figure 58: Reset Data in Voltage Calibration Screen

7.3 Force

Weld Force is one of the most critical resistance welding parameters. It is critical that the weld force is calibrated prior to use to ensure accurate measurements.

Calibrate Force Before Use
The Force must be calibrated before using the Hi5 Weld Monitor

The force calibration procedure is defined in Table 65. The Hi5 Weld Monitor has four ranges for force (2KN, 10KN, 20KN, and 50KN). The calibration procedure requires an external weld force gauge to correlate the internally measured values to the force measured by the external device.

Step	Icon / Action	Description
1		Tap the Return Arrow icon in the Header menu to go the Measure mode screen.
2	SYSTEM SETUP	Tap the **SYSTEM SETUP** button in the footer menu. Type in the Supervisor Password to the pop-up window. After tapping OK, the screen will change to SYSTEM MANAGER.
3	CALIBRATE	Tap the **CALIBRATE** button in the footer menu. Type in the Calibration Password to the pop-up window. Then, tap OK.
4	SENSOR	Tap the **SENSOR** button in the footer menu.
5	Force Sensor	Enable the **FORCE SENSOR**.
6	FORCE	Tap the **FORCE** button in the footer to enter the calibration menus
7	Range 2KN	Set the calibration range. The available options are: • If the force unit is kN: o 2kN o 10kN o 50kN o 200kN • If the force unit is lbf: o 450 lbf o 2200 lbf o 11000 lbf o 45000 lbf • If the force unit is kgf: o 200 kgf o 1000 kgf o 5000 kgf o 20000 kgf

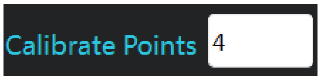
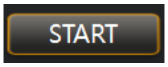
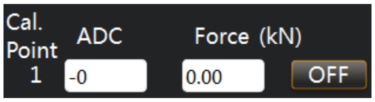
		Note: 1. To ensure accurate calibration, we recommend choosing a calibration range approximating the max weld force. 2. After calibration, the calibrated range will be used by all programs.
8		Set the number of calibration points. Note: 1. The calibration points can be chosen between 2 and 6. 2. We recommend dividing the max weld force by the number of calibration points to determine the force increment. For instance, if the max weld force is 2kN and the number of calibration points is 4, the force should increase by 0.5kN per calibration point.
9		Tap the **START** to begin the calibration process. The **START** will change to **STOP**.
10		The calibration will start at the first row of the calibration table. Tap the **OFF** to change it to **ON**. The ADC value at the first row will be automatically updated. Next, type in the reference weld force gauge's reading at the right textbox, and then tap the **ON** to change it to **OFF**. The first calibration point is then finished.
11		Move to the second row of the calibration table. Tap the **OFF** to change it to **ON**. Next, increase the weld force. The ADC value at the second row will be automatically updated. Next, type in the reference weld force gauge's reading at the right textbox, and then tap the **ON** to change it to **OFF**. The second calibration point is then finished.
12		Repeat Step 11 until the number of calibrated points reaches the value defined in the **CALIBRATE POINTS** field.
13		Tap **STOP** to stop the calibration procedure.

Table 65: Force Calibration Procedure

After the force calibration is complete, the graphical view will show the force calibration for your machine. An example is shown in Figure 59.

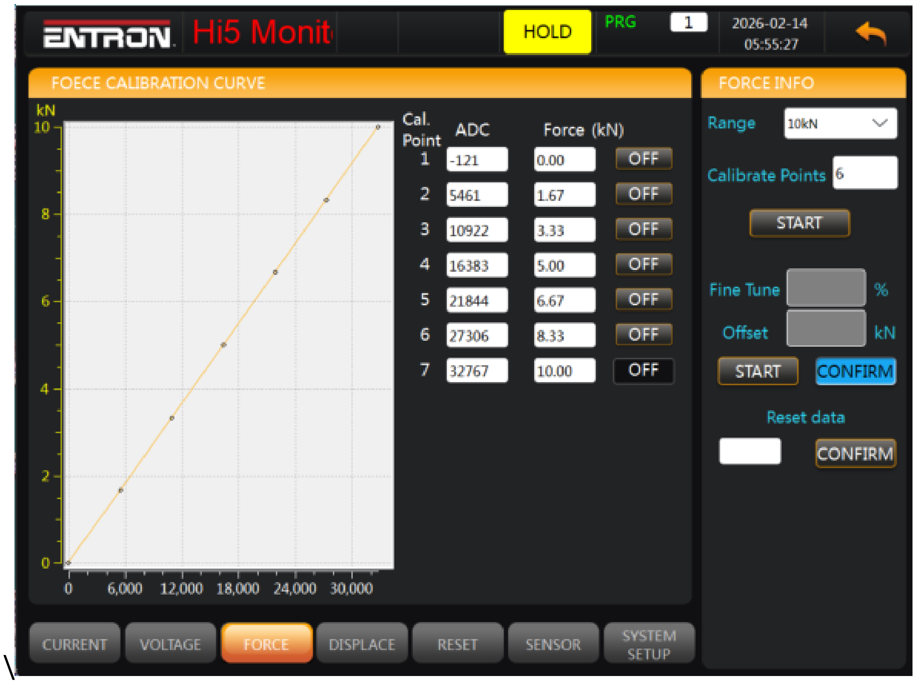


Figure 59: Force Calibration Screen

7.3.1 Reset Force Calibration

The user can reset the calibration settings for the force range (2KN, 10KN, 20KN, and 50KN) by entering the superuser password in the Reset Data field and tapping CONFIRM.

Figure 60: Reset Data in Force Calibration Screen

7.4 Displacement

The Displacement Calibration procedure is only available with Analog Displacement Sensors. Refer to the **ANALOG DISPLACEMENT SENSOR** section for instructions. The encoder style Displacement Sensors are absolute and do not require calibration.

7.4.1 Analog Displacement Sensor Calibration

The steps to calibrate the upper analog displacement sensor are defined in Table 66. The same calibration procedure can be applied to the lower displacement sensor. During ADC calibration, a reference displacement sensor is required to correlate the ADC output of the analog displacement sensor with the physical measurement.

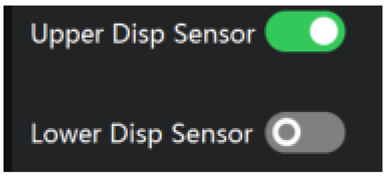
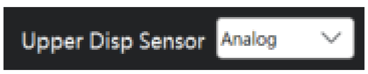
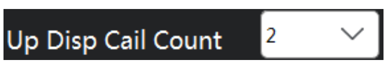
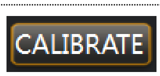
Step	Icon / Action	Description
1		Verify the desired displacement sensor is enabled in the Sensor Switch Configuration. This can be found on the **SYSTEM SETUP** -> **CALIBRATE** -> **SENSOR** page
2		Verify the desired displacement sensor is set to **Analog**
3		Set the number of calibration points ranging between 2 and 5 points.
4		The calibration will start at the first row in the 0 position of the ADC calibration table. When tapping the SAMPLE button, the ADC value will be automatically updated to the left textbox. Next, type in the measurement from the reference displacement sensor's reading in the Value (mm) text box. The first calibration point is then finished.
5		Move to the second row of the ADC calibration table. Drag the magnet on the analog displacement sensor at a pre-defined direction. Next, tap the SAMPLE button, the ADC value will be automatically updated to the left textbox. type in the measurement from the reference displacement sensor's reading in the Value (mm) text box. The second calibration point is then finished.
6		Repeat Steps 5 until the number of calibrated points reaches the value defined in the Up Disp Cail Count 2 field.
7		Tap CALIBRATE to finish the ADC calibration procedure.

Table 66: Analog Displacement Sensor Calibration

7.4.2 Displacement Calibration

Both analog and encoder displacement sensors require displacement calibration, which is for configuring the electrode origin and the electrode reference location. Figure 61 shows the displacement calibration screen, where the left portion is for the upper displacement sensor, while the right portion is for the lower displacement sensor.

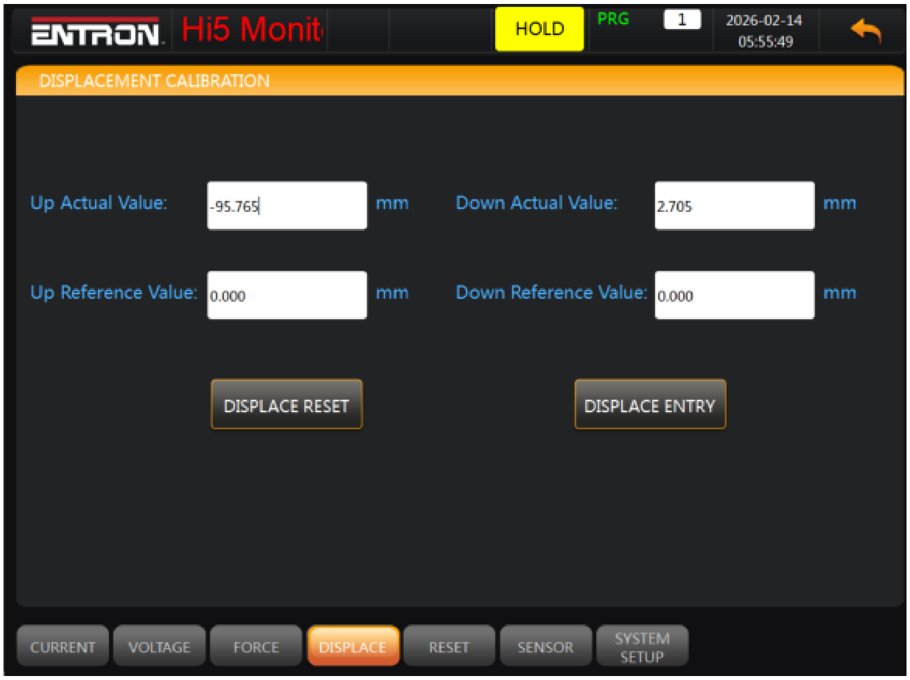


Figure 61: Displacement Calibration Screen - Set Electrode Reference Position

Table 67 defines the displacement calibration procedure for the upper displacement sensor. The same calibration procedure can be applied to the lower displacement sensor.

Step	Icon / Action	Description
1	Upper Disp Sensor Lower Disp Sensor	Verify the desired displacement sensor is enabled in the Sensor Switch Configuration. This can be found on the **SYSTEM SETUP -> CALIBRATE -> SENSOR** page
2	Upper Disp Sensor 5µm/pulse	Verify the desired displacement sensor is set to the correct value. **Analog sensors require calibration prior to the next step. See Section ANALOG DISPLACEMENT SENSOR CALIBRATION for more information.**
3	DISPLACE	Navigate to the Displacement Calibration page by tapping the **DISPLACE** icon in the footer menu.
4	DISPLACE RESET	Open the electrode on the machine, and then tap DISPLACE RESET to set the electrode origin.
5	Up Realtime Value: 0.000 mm	The Up Realtime Value will change to zero automatically.

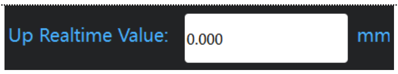
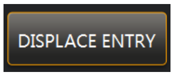
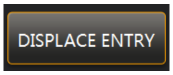
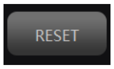
		Note: After this step,  will display the real-time location of the electrode.
6		Put the weld parts on the machine and then close the electrode. Next, tap  to record the electrode reference location.
7		The Up Reference Value will be updated automatically. The displacement calibration for the upper displacement sensor is then finished.

Table 67: Displacement Calibration to Set Electrode Reference Position

7.5 Reset to Factory Calibrations

Reset to Factory Calibrations page is used to reset the calibration values of current, voltage, force, and displacement for all ranges to the default data. After entering the Manufacturer password, press the confirm reset button to reset the entire calibration table.

To navigate to the Reset screen, tap the  icon in the footer in the Calibration Menus.

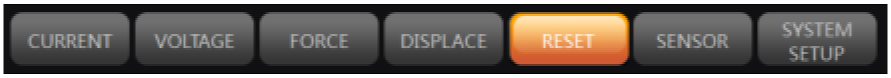


Figure 62: Calibration Footer Menu with the Reset Screen Selected

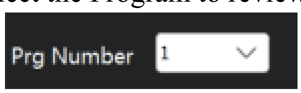
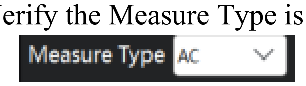
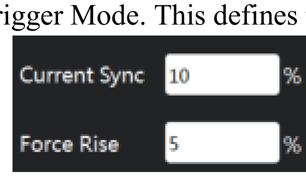
Figure 63: Reset Calibration Screen

8 FAULTS & TROUBLESHOOTING

This section of the manual provides an overview of the fault and error messages output by the Hi5 Weld Monitor. When an error message is encountered, this section of the manual should be consulted for a detailed definition of the fault or error message.

8.1 Device Not Triggered

The Device Not Triggered error occurs when the device trigger signal (current or force) is present, but the Hi5 Monitor does not record the weld. The Device Not Triggered issue can be caused by multiple factors. The primary factors and troubleshooting steps are defined in Table 68.

Potential Issue	Resolution
Program Mismatch or Setup Error	The active Program is shown in the header menu.  Verify that the Program settings are properly defined. From the Measure page, navigate to the Program page by tapping SET UP -> PROGRAM. 1. Select the Program to review  2. Verify the Trigger Mode is set correctly (Current or Force)  3. Verify the Measure Type is set correctly for your welder (AC, DC, CD)  4. Verify the Current Range is set correctly for your welder  5. Verify the Pulse Mode is set properly, and the Number Pulses are properly defined  6. Verify the Current Sync % or Force Rise% is set properly based on the Trigger Mode. This defines the start condition for the trigger.  7. Verify the Current End % and Force Drop % is set properly based on the Trigger mode. This defines the end condition trigger.

	
Hardware Connection Issue	Verify the electrical connections are secure for the all sensors, the connections are properly wired, and there are no broken or damaged cables.

Table 68: Device Not Triggered Troubleshooting Guide

8.2 No Curve Displayed After Being Triggered

When the Hi5 Monitor starts recording, the header menu will show **TRIGGERED** in the header menu. After the weld is completed, the graph on the measure page will automatically refresh to show the last recorded weld. When graph is not updated, the user should follow the steps in Table 69 to troubleshoot.

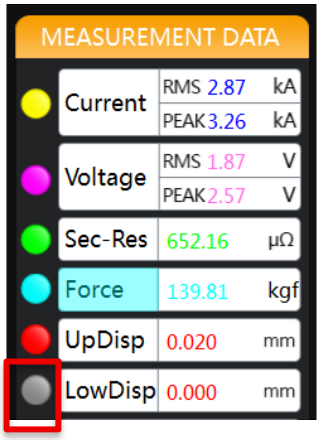
Potential Issue	Resolution
Signal Missing from Graph	Verify the signal is not hidden from the graphic in the Measurement Data section. A grey circle indicates the signal is not displayed. Tap the circle to enable the signal on the graph. 
Zoom Setting Issue	If the signal is enabled for display and not visible, the Zoom Settings should be reviewed. 1. Tap the **HOLD DISPLAY** button to go to the Waveform Analysis Page 2. Tap the **AUTO** button to auto-scale the data 3. Use the Curve Sel drop down to select the curve you want to modify 4. Use the **X+**, **X-, Y+, & Y-** buttons to zoom adjust the zoom on the selected curve 5. Once you have the signal properly displayed, tap **MEASUREMENT MODE** to return to the Measure screen. The Zoom settings from the Waveform Analysis page will be synced with the Measure screen.

Table 69: No Curve Displayed After Being Triggered Troubleshooting Guide

8.3 Triggered Status Stuck

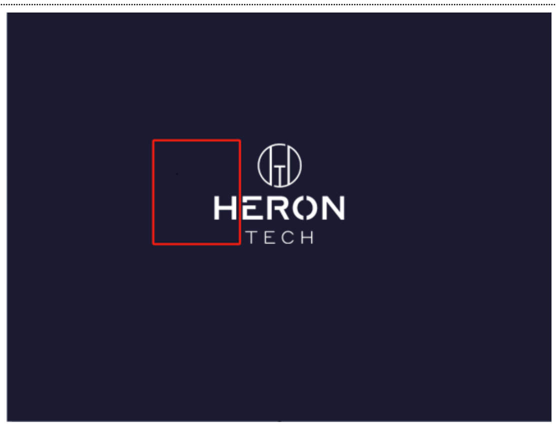
In the event the Triggered Status gets stuck and the screen is unresponsive, the user should follow the steps in Table 70 to resolve the issue.

Potential Issue	Resolution
Check the Force Sensor Connection	When the force sensor is not connected, the device will be put in the TRIGGERED state due to the missing signal. 1.Verify Force Sensor is connected to the Hi5 2. Verify the Force Sensor is properly wired 3. If no Force Sensor is connected, navigate to the Sensor Page and turn OFF the Forse Sensor Toggle Switch. Also, verify that the active weld program's trigger mode is set to Current. Then turn the device OFF and then turn the device ON.
No Force Sensor Connected	Verify the Program is not set to Force. From the Measure page, navigate to the Program page by tapping SET UP -> PROGRAM. 1. Verify the Trigger Mode is set Current 
Firmware Check	Verify the Firmware is V1.0.81 or greater. This version of firmware has a delay of 3 seconds before sampling of signals.

Table 70: Triggered Status Stuck Troubleshooting Procedure

8.4 Unresponsive Touchscreen Operation

When the touchscreen is not responsive, but a sound is emitted with tapping the screen; then the touchscreen calibration may be lost. To correct this the touchscreen needs to be recalibrated by following the steps below in Table 71.

Step	Icon / Action	Description
1		Power OFF the device.
2		Power on the device.
3		During start up of the device, press with your finger the area to the left of the "H" in Heron.

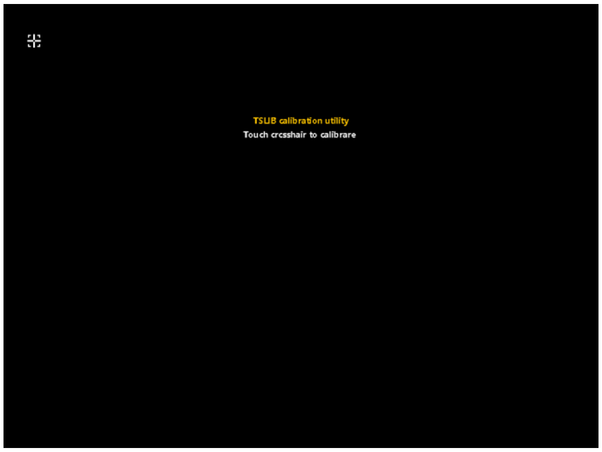
4		Continue to press until a black screen appears as shown
5		Power the device OFF
6		Power the device ON
7		The device will boot in the touchscreen calibration Mode.
8		With your finger or a touchscreen pen, tap and hold the white cross hair inside the red circle labeled number 1.
9		Repeat step 8 until all 5 circles have been touched
10		After calibration is complete, the Hi5 Monitor will boot normally

Table 71: Touchscreen Calibration Instructions

8.5 SD Card Not Detected

When no SD card is present, you will receive a popup message at start up as shown in Figure 64.

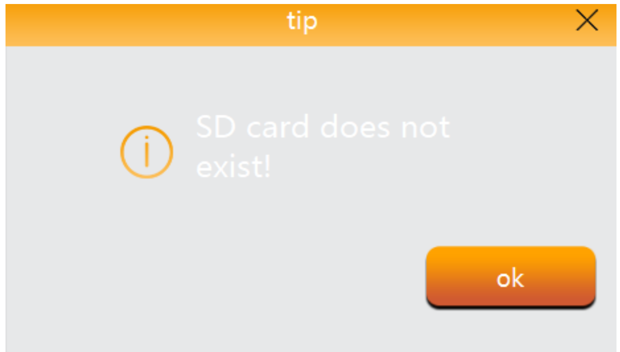


Figure 64: SD Card Does Not Exist Prompt

To resolve this issue, follow the steps in Table 72:

Step	Icon / Action	Description
1	DATA LOG	From the Monitor page, tap DATA LOG in the footer menu
2	STORAGE MGMT	Then tap STORAGE MGMT to access the Storage Management page
3	Format SD Card CONFIRM	Tap CONFIRM for Format SD Card
4	format SD card confirm	During the formatting process, the CONFIRM button will grey out. **Note:** If the formatting process takes less than 10 seconds, the SD card may not be properly installed. Check the card is properly seated in the SD card slot
5	format SD card ✓ confirm	Once the process is complete, the CONFIRM button will show a check mark

Table 72: Instructions to Format SD Card

8.6 Device Fails to Start

This issue occurs when a sudden power outage or other unexpected events interrupt the software update process, resulting in a failed update. The device cannot enter the application interface after restarting.

To resolve this issue, try the steps in Table 73.

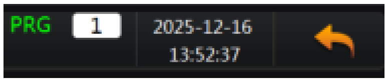
Step	Icon / Action	Description
1		Power OFF the device.
2		Power on the device.
3		During start up of the device, press with your finger the area to the right of the “N” in Heron.
4		The device will enter the backup application interface
5		Insert USB with the latest firmware
6		Load the firmware

Table 73: Device Fails to Start - Update Firmware Instructions

8.7 Current Range Too Low

During measurement, the page may automatically switch to the "Specification Settings" interface, and a pop-up prompt saying "Current Range is too low”.

To resolve this issue, follow the steps in Table 74.

Step	Icon / Action	Description
1		Navigate to the Program page by tapping SET UP-> PROGRAM on the footer menus
2		Select the program shown in the header menu (i.e. active program)

	Prg Number 1	
3	Current Range 20KA	Select the proper Current Range is set properly for your welder and application. The options are 6KA, 20KA, 60KA, 200KA, 1000KA
4		Tap the Return Arrow button on the header menu to return to the Measure page
5		Make a weld with your weld to confirm the Hi5 is properly triggered

Table 74: Current Range Too Low Troubleshooting Instructions

8.8 Measurement Failure or Inconsistent Results

This refers to scenarios such as failure to trigger, significant deviation between the measured calculation value and the actual value, or incorrect number of pulses during measurement.

To resolve these issues, you can try the following steps in Table 75.

Step	Icon / Action	Description
1	SET UP PROGRAM	Navigate to the Program page by tapping SET UP-> PROGRAM on the footer menus
2	PRG 1 2025-12-16 13:52:37 Prg Number 1	Select the program shown in the header menu (i.e. active program)
3	Measure Type AC	Verify the Measurement Type is set correctly for your machine and application (AC, DC, CD)
4	Trigger Mode Current	Verify the Trigger Mode is set correctly (Current or Force)
5	Current Range 20KA	Select the proper Current Range is set properly for your welder and application. The options are 6KA, 20KA, 60KA, 200KA, 1000KA
6	Pulse Mode Multi	Verify the Pulse Mode is set properly. See PULSE SETTINGS Section for more information.
7	Current Sync 10 % Force Rise 5 %	Verify the Current Sync % or Force Rise% is set properly based on the Trigger Mode. This defines the start condition for the trigger

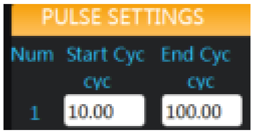
8		Verify the Current End % and Force Drop % is set properly based on the Trigger mode. This defines the end condition trigger.
9		Tap Pulse Period Data Settings button to go to the Pulse Settings page.
10		Verify the Start and End time for the pulse settings are set correctly.
11		Tap the Return Arrow button on the header menu to return to the Measure page
12		Make a weld to confirm the Hi5 is properly triggered

Table 75: Measurement Failure or Inconsistent Results Troubleshooting Instructions

9 DIGITAL INPUTS & OUTPUTS

The Hi5 welding monitor currently supports 4 channels of GPIO input and 4 channels of GPIO output. As shown in the

WIRING Diagram section, (X3) is the GPIO output port, and (X4) is the GPIO input port.

9.1 Inputs

The Digital Inputs are defined as connection X4. The Digital Inputs are currently **reserved for future use**. There is no active functionality associated with the input connections.

Input signal connections must use only a 24V DC power supply (IO24V). Do not connect to 110V AC power.

WARNING!

24V DC
Digital Inputs must use 24V DC power only. Do ***not*** connect to 110V AC.

9.2 Outputs

The Digital Outputs are defined as connection X3. Currently, only Pin 1 and Pin 2 are in use. **The remaining Pins are reserved for future use.** The active Digital Input Connections are defined in Table 76. The Alarm Output (Pin 2) activates with 24V when the Hi5 Weld Monitor has set a Weld Alarm which can be used to activate a lamp or notify an external device of the Alarm.

WARNING!

24V DC
Digital Outputs must use 24V DC power only. Do ***not*** connect to 110V AC.

Refer to the WIRING DIAGRAM section for more information.

Item	Terminal Label	Designator	Pin	Description
Digital Outputs	X3	VDD	1	24V output from the Digital Outputs
		Alarm	2	The 24V output with maximum current of 500mA for alarm signals

Table 76: Digital Outputs List

10 READ & WRITE DATA WITH EXTERNAL DEVICES

The Hi5 welding monitor is designed to be integrated into an industrial automation system and controlled by an external master device. This section is written for PLC programmers familiar with programming read/write messages via MODBUS and HTTP protocols.

The Hi5 monitor supports MODBUS communication through a RS-232 serial port. The Hi5 monitor supports HTTP and MODBUS communication through the Ethernet port.

For information on how to configure and connect the Hi5 monitor for your desired communication protocol refer to the **NETWORK SETTINGS** section.

10.1 MODBUS

The Hi5 MODBUS communication exchanges both I/O data and the welding parameters with remote MODBUS devices. MODBUS communication can be performed through the RS232 Serial Port and the Ethernet port.

MODBUS STANDARD
Modbus is an open system and the full details are freely available at www.modbus.org

10.1.1 Function Codes

The Hi5 Monitor control supports three MODBUS function codes as shown in Table 77.

Function Code	Type	Description
6	Write	Code to write parameters to a single address, with the maximum address not exceeding 1199.
10	Write	Code to write to multiple consecutive addresses of the parameters. The length of the data packet must not exceed 123. The maximum address must not exceed 1199.
3	Read	Code to read specification and display parameters. The length of the data read must not exceed 125, and the maximum address must not exceed 2262.

Table 77: Read Write Function Codes

Write During Recording
When the device is in trigger mode and actively recording a weld, any modifications made to the parameters of the current measurement specificaiton will be written only after the recording is completed.

10.1.2 Program Parameters

The Hi5 monitor accepts read and write messages from the Modbus Master (PLC or other Modbus devices) for the Program Parameters using the function codes defined in Table 77. The Alarm Settings are defined in two words and defined in Table 79.

Read / Write on Active Program Only
To read or write to a specific program, the user must set the program on the Hi5 Monitor. Then a message to read or write Program Parameter data can be sent using the Modbus message.

The data structure of the Inputs data is shown in Table 78.

Absolute address	Address Name	Address description	Data Type	Min. Value	Max. Value	Explanation of Data Value Definition
0	mpMeasureNumber	measure program number	Integer	0	999	**Before setting the program parameters, the program number must be set first.** (For example, if you want to set the triggering mode of program No. 2 to "current", you need to set the program number to 2 first. After the setting is completed, the addresses (1-1199) will be updated to the data of program No. 2. At this time, you can set the triggering mode(absolute address is 2) to "current" and other parameters of program No. 2.
1	mpMeasureType	measure type	Integer	0	2	0:Medium-frequency direct current (for short:DC) 1:Alternating current (for short:AC) 2:Energy storage (for short: CD)
2	mpTriggerMode	trigger mode	Integer	0	1	0: Current triggering 1: Force triggering
3	mpCurrentRange	current range	Integer	0	4	0:6KA 1:20KA 2:60KA 3:200KA 4:1000KA
4	mpVoltageRange	voltage range	Integer	0	1	0:20V 1:60V
5	mpPulseMode	pulse mode	Integer	0	2	0: Single pulse 1: Multiple pulses 2: Specified pulse
6	mpCurrentCalculateMode	current calculation mode (valid only when the measure type is CD)	Integer	0	1	0: Automatic calculation 1: User setting(need to set the start and end cycles on the pulse setting page)

7	mpPulseCount	number of pulses	Integer	0	9	Corresponding to the number of pulses from 1 to 10
8	mpSpecifyPulse	specified pulse (valid only when the pulse mode is specified pulse)	Integer	0	9	Corresponding to pulses 1 - 10
9	mpFrequency	AC frequency (Hz) (Valid only when the measure type is AC)	Integer	5	400	Default 50Hz
10	mpCurrentEndLevel	current end level (percentage of the current range) (Valid only when the trigger mode is set to current)	Integer	5	20	
11	mpForceUpLevel	force rise level (percentage of the force range) (Valid only when the trigger mode is set to force)	Integer	5	20	
12	mpForceDownLevel	force drop level (percentage of the force range) (Valid only when the trigger mode is set to force)	Integer	5	20	
13	mpMeasureOffTime	measure rest time (ms)	Integer	0	2000	
14	mpCurrentOverEnvelopeCount	current over envelope count	Integer	0	50	
15	mpResistanceOverEnvelopeCount	resistance over envelope count	Integer	0	50	
16	mpDisplacementOverEnvelopeCount	displacement over envelope count	Integer	0	50	
17	mForceOverEnvelopeCount	force over envelope count	Integer	0	50	
18	mpCurrentRmsOverrunCount	number of continuous over - limit times of the RMS value of current	Integer	0	50	If the results of multiple consecutive measurements exceed the limit, and if they are not consecutive, the counting will restart from 0.
19	mpCurrentPeakOverrunCount	number of continuous over - limit times of the peak value of current	Integer	0	50	If the results of multiple consecutive measurements exceed the limit, and if they are not consecutive, the counting will restart from 0.
20	mpResistanceRmsOverrunCount	number of continuous over - limit times of the RMS value of resistance	Integer	0	50	If the results of multiple consecutive measurements exceed the limit, and if they are not consecutive, the counting will restart from 0.
21	mpVoltageRmsOverrunCount	number of continuous over - limit times of the RMS value of voltage	Integer	0	50	If the results of multiple consecutive measurements exceed the limit, and if they are not consecutive, the counting will restart from 0.
22	mpDisplacementRmsOverrunCount	number of continuous over - limit times of the RMS value of displacement	Integer	0	50	If the results of multiple consecutive measurements exceed the limit, and if they are not consecutive, the counting will restart from 0.

23	mpForceRmsOverrunCount	number of continuous over - limit times of the RMS value of force	Integer	0	50	If the results of multiple consecutive measurements exceed the limit, and if they are not consecutive, the counting will restart from 0.
24	mpForceUnit	unit of force(It can only be retrieved, not set)	Integer	0	2	0:KN 1:LBF 2:KGF
25	mpForceRange	force range(It can only be retrieved, not set)	Integer	0	11	0:2KN 1:10KN 2:50KN 3:200KN 4:450LBF 5:2200LBF 6:11000LBF 7:45000LBF 8:200KGF 9:1000KGF 10:5000KGF 11:20000KGF
26	mpSlaveAddress	modbus slave addresss (It can only be retrieved, not set)	Integer	1	255	Set it in the communication settings interface.
27	mpAlarmSettings1	alarm switch1	Integer			please refer to the alarm bit address table for details (Table 79)
28	mpAlarmSettings2	alarm switch2	Integer			please refer to the alarm bit address table for details (Table 79)
29-39	mpReserve29-39	reserve address	Integer			
40	mpCurrentUpEnvelopePercent_0	upper envelope of current curve pulse 1 (percentage)	Integer	0	50	
41	mpCurrentUpEnvelopePercent_1	upper envelope of current curve pulse 2 (percentage)	Integer	0	50	
42	mpCurrentUpEnvelopePercent_2	upper envelope of current curve pulse 3 (percentage)	Integer	0	50	
43	mpCurrentUpEnvelopePercent_3	upper envelope of current curve pulse 4 (percentage)	Integer	0	50	
44	mpCurrentUpEnvelopePercent_4	upper envelope of current curve pulse 5 (percentage)	Integer	0	50	
45	mpCurrentUpEnvelopePercent_5	upper envelope of current curve pulse 6 (percentage)	Integer	0	50	
46	mpCurrentUpEnvelopePercent_6	upper envelope of current curve pulse 7 (percentage)	Integer	0	50	
47	mpCurrentUpEnvelopePercent_7	upper envelope of current curve pulse 8 (percentage)	Integer	0	50	
48	mpCurrentUpEnvelopePercent_8	upper envelope of current curve pulse 9 (percentage)	Integer	0	50	

49	mpCurrentUpEnvelopePercent_9	upper envelope of current curve pulse 10 (percentage)	Integer	0	50	
50	mpCurrentDownEnvelopePercent_0	lower envelope of current curve pulse 1 (percentage)	Integer	0	50	
51	mpCurrentDownEnvelopePercent_1	lower envelope of current curve pulse 2 (percentage)	Integer	0	50	
52	mpCurrentDownEnvelopePercent_2	lower envelope of current curve pulse 3 (percentage)	Integer	0	50	
53	mpCurrentDownEnvelopePercent_3	lower envelope of current curve pulse 4 (percentage)	Integer	0	50	
54	mpCurrentDownEnvelopePercent_4	lower envelope of current curve pulse 5 (percentage)	Integer	0	50	
55	mpCurrentDownEnvelopePercent_5	lower envelope of current curve pulse 6 (percentage)	Integer	0	50	
56	mpCurrentDownEnvelopePercent_6	lower envelope of current curve pulse 7 (percentage)	Integer	0	50	
57	mpCurrentDownEnvelopePercent_7	lower envelope of current curve pulse 8 (percentage)	Integer	0	50	
58	mpCurrentDownEnvelopePercent_8	lower envelope of current curve pulse 9 (percentage)	Integer	0	50	
59	mpCurrentDownEnvelopePercent_9	lower envelope of current curve pulse 10 (percentage)	Integer	0	50	
60	mpResistanceUpEnvelopePercent_0	upper envelope of resistance curve pulse 1 (percentage)	Integer	0	50	
61	mpResistanceUpEnvelopePercent_1	upper envelope of resistance curve pulse 2 (percentage)	Integer	0	50	
62	mpResistanceUpEnvelopePercent_2	upper envelope of resistance curve pulse 3 (percentage)	Integer	0	50	
63	mpResistanceUpEnvelopePercent_3	upper envelope of resistance curve pulse 4 (percentage)	Integer	0	50	
64	mpResistanceUpEnvelopePercent_4	upper envelope of resistance curve pulse 5 (percentage)	Integer	0	50	
65	mpResistanceUpEnvelopePercent_5	upper envelope of resistance curve pulse 6 (percentage)	Integer	0	50	
66	mpResistanceUpEnvelopePercent_6	upper envelope of resistance curve pulse 7 (percentage)	Integer	0	50	
67	mpResistanceUpEnvelopePercent_7	upper envelope of resistance curve pulse 8 (percentage)	Integer	0	50	
68	mpResistanceUpEnvelopePercent_8	upper envelope of resistance curve pulse 9 (percentage)	Integer	0	50	

69	mpResistanceUpEnvelopePercent_9	upper envelope of resistance curve pulse 10 (percentage)	Integer	0	50	
70	mpResistancetDownEnvelopePercent_0	lower envelope of resistance curve pulse 1 (percentage)	Integer	0	50	
71	mpResistancetDownEnvelopePercent_1	lower envelope of resistance curve pulse 2 (percentage)	Integer	0	50	
72	mpResistancetDownEnvelopePercent_2	lower envelope of resistance curve pulse 3 (percentage)	Integer	0	50	
73	mpResistancetDownEnvelopePercent_3	lower envelope of resistance curve pulse 4 (percentage)	Integer	0	50	
74	mpResistancetDownEnvelopePercent_4	lower envelope of resistance curve pulse 5 (percentage)	Integer	0	50	
75	mpResistancetDownEnvelopePercent_5	lower envelope of resistance curve pulse 6 (percentage)	Integer	0	50	
76	mpResistancetDownEnvelopePercent_6	lower envelope of resistance curve pulse 7 (percentage)	Integer	0	50	
77	mpResistancetDownEnvelopePercent_7	lower envelope of resistance curve pulse 8 (percentage)	Integer	0	50	
78	mpResistancetDownEnvelopePercent_8	lower envelope of resistance curve pulse 9 (percentage)	Integer	0	50	
79	mpResistancetDownEnvelopePercent_9	lower envelope of resistance curve pulse 10 (percentage)	Integer	0	50	
80	mpDisplacementUpEnvelopePercent_0	upper envelope of displacement curve pulse 1 (percentage)	Integer	0	50	
81	mpDisplacementUpEnvelopePercent_1	upper envelope of displacement curve pulse 2 (percentage)	Integer	0	50	
82	mpDisplacementUpEnvelopePercent_2	upper envelope of displacement curve pulse 3 (percentage)	Integer	0	50	
83	mpDisplacementUpEnvelopePercent_3	upper envelope of displacement curve pulse 4 (percentage)	Integer	0	50	
84	mpDisplacementUpEnvelopePercent_4	upper envelope of displacement curve pulse 5 (percentage)	Integer	0	50	
85	mpDisplacementUpEnvelopePercent_5	upper envelope of displacement curve pulse 6 (percentage)	Integer	0	50	
86	mpDisplacementUpEnvelopePercent_6	upper envelope of displacement curve pulse 7 (percentage)	Integer	0	50	
87	mpDisplacementUpEnvelopePercent_7	upper envelope of displacement curve pulse 8 (percentage)	Integer	0	50	

88	mpDisplacementUpEnvelopePercent_8	upper envelope of displacement curve pulse 9 (percentage)	Integer	0	50	
89	mpDisplacementUpEnvelopePercent_9	upper envelope of displacement curve pulse 10 (percentage)	Integer	0	50	
90	mpDisplacementDownEnvelopePercent_0	lower envelope of displacement curve pulse 1 (percentage)	Integer	0	50	
91	mpDisplacementDownEnvelopePercent_1	lower envelope of displacement curve pulse 2 (percentage)	Integer	0	50	
92	mpDisplacementDownEnvelopePercent_2	lower envelope of displacement curve pulse 3 (percentage)	Integer	0	50	
93	mpDisplacementDownEnvelopePercent_3	lower envelope of displacement curve pulse 4 (percentage)	Integer	0	50	
94	mpDisplacementDownEnvelopePercent_4	lower envelope of displacement curve pulse 5 (percentage)	Integer	0	50	
95	mpDisplacementDownEnvelopePercent_5	lower envelope of displacement curve pulse 6 (percentage)	Integer	0	50	
96	mpDisplacementDownEnvelopePercent_6	lower envelope of displacement curve pulse 7 (percentage)	Integer	0	50	
97	mpDisplacementDownEnvelopePercent_7	lower envelope of displacement curve pulse 8 (percentage)	Integer	0	50	
98	mpDisplacementDownEnvelopePercent_8	lower envelope of displacement curve pulse 9 (percentage)	Integer	0	50	
99	mpDisplacementDownEnvelopePercent_9	lower envelope of displacement curve pulse 10 (percentage)	Integer	0	50	
100	mpForceUpEnvelopePercent_0	upper envelope of the force curve pulse 1 (percentage)	Integer	0	50	
101	mpForceUpEnvelopePercent_1	upper envelope of the force curve pulse 2 (percentage)	Integer	0	50	
102	mpForceUpEnvelopePercent_2	upper envelope of the force curve pulse 3 (percentage)	Integer	0	50	
103	mpForceUpEnvelopePercent_3	upper envelope of the force curve pulse 4 (percentage)	Integer	0	50	
104	mpForceUpEnvelopePercent_4	upper envelope of the force curve pulse 5 (percentage)	Integer	0	50	
105	mpForceeUpEnvelopePercent_5	upper envelope of the force curve pulse 6 (percentage)	Integer	0	50	
106	mpForceUpEnvelopePercent_6	upper envelope of the force curve pulse 7 (percentage)	Integer	0	50	
107	mpForceUpEnvelopePercent_7	upper envelope of the force curve pulse 8 (percentage)	Integer	0	50	

108	mpForceUpEnvelopePercent_8	upper envelope of the force curve pulse 9 (percentage)	Integer	0	50	
109	mpForceUpEnvelopePercent_9	upper envelope of the force curve pulse 10 (percentage)	Integer	0	50	
110	mpForceDownEnvelopePercent_0	lower envelope of the force curve pulse 1 (percentage)	Integer	0	50	
111	mpForceDownEnvelopePercent_1	lower envelope of the force curve pulse 2 (percentage)	Integer	0	50	
112	mpForceDownEnvelopePercent_2	lower envelope of the force curve pulse 3 (percentage)	Integer	0	50	
113	mpForceDownEnvelopePercent_3	lower envelope of the force curve pulse 4 (percentage)	Integer	0	50	
114	mpForceDownEnvelopePercent_4	lower envelope of the force curve pulse 5 (percentage)	Integer	0	50	
115	mpForceDownEnvelopePercent_5	lower envelope of the force curve pulse 6 (percentage)	Integer	0	50	
116	mpForceDownEnvelopePercent_6	lower envelope of the force curve pulse 7 (percentage)	Integer	0	50	
117	mpForceDownEnvelopePercent_7	lower envelope of the force curve pulse 8 (percentage)	Integer	0	50	
118	mpForceDownEnvelopePercent_8	lower envelope of the force curve pulse 9 (percentage)	Integer	0	50	
119	mpForceDownEnvelopePercent_9	lower envelope of the force curve pulse 10 (percentage)	Integer	0	50	
120	mpCurrentRmsUpRangePercent_0	upper limit value of RMS of current pulse 1 (percentage)	Integer	0	50	
121	mpCurrentRmsUpRangePercent_1	Upper limit value of RMS of current pulse 2 (percentage)	Integer	0	50	
122	mpCurrentRmsUpRangePercent_2	upper limit value of RMS of current pulse 3 (percentage)	Integer	0	50	
123	mpCurrentRmsUpRangePercent_3	upper limit value of RMS of current pulse 4 (percentage)	Integer	0	50	
124	mpCurrentRmsUpRangePercent_4	upper limit value of RMS of current pulse 5 (percentage)	Integer	0	50	
125	mpCurrentRmsUpRangePercent_5	upper limit value of RMS of current pulse 6 (percentage)	Integer	0	50	
126	mpCurrentRmsUpRangePercent_6	upper limit value of RMS of current pulse 7 (percentage)	Integer	0	50	
127	mpCurrentRmsUpRangePercent_7	upper limit value of RMS of current pulse 8 (percentage)	Integer	0	50	
128	mpCurrentRmsUpRangePercent_8	upper limit value of RMS of current pulse 9 (percentage)	Integer	0	50	

129	mpCurrentRmsUpRangePercent_9	upper limit value of RMS of current pulse 10 (percentage)	Integer	0	50	
130	mpCurrentRmsDownRangePercent_0	lower limit value of RMS of current pulse 1 (percentage)	Integer	0	50	
131	mpCurrentRmsDownRangePercent_1	lower limit value of RMS of current pulse 2 (percentage)	Integer	0	50	
132	mpCurrentRmsDownRangePercent_2	lower limit value of RMS of current pulse 3 (percentage)	Integer	0	50	
133	mpCurrentRmsDownRangePercent_3	lower limit value of RMS of current pulse 4 (percentage)	Integer	0	50	
134	mpCurrentRmsDownRangePercent_4	lower limit value of RMS of current pulse 5 (percentage)	Integer	0	50	
135	mpCurrentRmsDownRangePercent_5	lower limit value of RMS of current pulse 6 (percentage)	Integer	0	50	
136	mpCurrentRmsDownRangePercent_6	lower limit value of RMS of current pulse 7 (percentage)	Integer	0	50	
137	mpCurrentRmsDownRangePercent_7	lower limit value of RMS of current pulse 8 (percentage)	Integer	0	50	
138	mpCurrentRmsDownRangePercent_8	lower limit value of RMS of current pulse 9 (percentage)	Integer	0	50	
139	mpCurrentRmsDownRangePercent_9	lower limit value of RMS of current pulse 10 (percentage)	Integer	0	50	
140	mpResistanceRmsUpRangePercent_0	upper limit value of RMS of resistance pulse 1 (percentage)	Integer	0	50	
141	mpResistanceRmsUpRangePercent_1	upper limit value of RMS of resistance pulse 2 (percentage)	Integer	0	50	
142	mpResistanceRmsUpRangePercent_2	upper limit value of RMS of resistance pulse 3 (percentage)	Integer	0	50	
143	mpResistanceRmsUpRangePercent_3	upper limit value of RMS of resistance pulse 4 (percentage)	Integer	0	50	
144	mpResistanceRmsUpRangePercent_4	upper limit value of RMS of resistance pulse 5 (percentage)	Integer	0	50	
145	mpResistanceRmsUpRangePercent_5	upper limit value of RMS of resistance pulse 6 (percentage)	Integer	0	50	
146	mpResistanceRmsUpRangePercent_6	upper limit value of RMS of resistance pulse 7 (percentage)	Integer	0	50	
147	mpResistanceRmsUpRangePercent_7	upper limit value of RMS of resistance pulse 8 (percentage)	Integer	0	50	
148	mpResistanceRmsUpRangePercent_8	upper limit value of RMS of resistance pulse 9 (percentage)	Integer	0	50	

149	mpResistanceRmsUpRangePercent_9	upper limit value of RMS of resistance pulse 10 (percentage)	Integer	0	50	
150	mpResistanceRmsDownRangePercent_0	lower limit value of RMS of resistance pulse 1 (percentage)	Integer	0	50	
151	mpResistanceRmsDownRangePercent_1	lower limit value of RMS of resistance pulse 2 (percentage)	Integer	0	50	
152	mpResistanceRmsDownRangePercent_2	lower limit value of RMS of resistance pulse 3 (percentage)	Integer	0	50	
153	mpResistanceRmsDownRangePercent_3	lower limit value of RMS of resistance pulse 4 (percentage)	Integer	0	50	
154	mpResistanceRmsDownRangePercent_4	lower limit value of RMS of resistance pulse 5 (percentage)	Integer	0	50	
155	mpResistanceRmsDownRangePercent_5	lower limit value of RMS of resistance pulse 6 (percentage)	Integer	0	50	
156	mpResistanceRmsDownRangePercent_6	lower limit value of RMS of resistance pulse 7 (percentage)	Integer	0	50	
157	mpResistanceRmsDownRangePercent_7	lower limit value of RMS of resistance pulse 8 (percentage)	Integer	0	50	
158	mpResistanceRmsDownRangePercent_8	lower limit value of RMS of resistance pulse 9 (percentage)	Integer	0	50	
159	mpResistanceRmsDownRangePercent_9	lower limit value of RMS of resistance pulse 10 (percentage)	Integer	0	50	
160	mpVoltageRmsUpRangePercent_0	upper limit value of RMS of voltage pulse 1 (percentage)	Integer	0	50	
161	mpVoltageRmsUpRangePercent_1	upper limit value of RMS of voltage pulse 2 (percentage)	Integer	0	50	
162	mpVoltageRmsUpRangePercent_2	upper limit value of RMS of voltage pulse 3 (percentage)	Integer	0	50	
163	mpVoltageRmsUpRangePercent_3	upper limit value of RMS of voltage pulse 4 (percentage)	Integer	0	50	
164	mpVoltageRmsUpRangePercent_4	upper limit value of RMS of voltage pulse 5 (percentage)	Integer	0	50	
165	mpVoltageRmsUpRangePercent_5	upper limit value of RMS of voltage pulse 6 (percentage)	Integer	0	50	
166	mpVoltageRmsUpRangePercent_6	upper limit value of RMS of voltage pulse 7 (percentage)	Integer	0	50	
167	mpVoltageRmsUpRangePercent_7	upper limit value of RMS of voltage pulse 8 (percentage)	Integer	0	50	
168	mpVoltageRmsUpRangePercent_8	upper limit value of RMS of voltage pulse 9 (percentage)	Integer	0	50	

169	mpVoltageRmsUpRangePercent_9	upper limit value of RMS of voltage pulse 10 (percentage)	Integer	0	50	
170	mpVoltageRmsDownRangePercent_0	lower limit value of RMS of voltage pulse 1 (percentage)	Integer	0	50	
171	mpVoltageRmsDownRangePercent_1	lower limit value of RMS of voltage pulse 2 (percentage)	Integer	0	50	
172	mpVoltageRmsDownRangePercent_2	lower limit value of RMS of voltage pulse 3 (percentage)	Integer	0	50	
173	mpVoltageRmsDownRangePercent_3	lower limit value of RMS of voltage pulse 4 (percentage)	Integer	0	50	
174	mpVoltageRmsDownRangePercent_4	lower limit value of RMS of voltage pulse 5 (percentage)	Integer	0	50	
175	mpVoltageRmsDownRangePercent_5	lower limit value of RMS of voltage pulse 6 (percentage)	Integer	0	50	
176	mpVoltageRmsDownRangePercent_6	lower limit value of RMS of voltage pulse 7 (percentage)	Integer	0	50	
177	mpVoltageRmsDownRangePercent_7	lower limit value of RMS of voltage pulse 8 (percentage)	Integer	0	50	
178	mpVoltageRmsDownRangePercent_8	lower limit value of RMS of voltage pulse 9 (percentage)	Integer	0	50	
179	mpVoltageRmsDownRangePercent_9	lower limit value of RMS of voltage pulse 10 (percentage)	Integer	0	50	
180	mpForceRmsUpRangePercent_0	upper limit value of RMS of force pulse 1 (percentage)	Integer	0	50	
181	mpForceRmsUpRangePercent_1	upper limit value of RMS of force pulse 2 (percentage)	Integer	0	50	
182	mpForceRmsUpRangePercent_2	upper limit value of RMS of force pulse 3 (percentage)	Integer	0	50	
183	mpForceRmsUpRangePercent_3	upper limit value of RMS of force pulse 4 (percentage)	Integer	0	50	
184	mpForceRmsUpRangePercent_4	upper limit value of RMS of force pulse 5 (percentage)	Integer	0	50	
185	mpForceRmsUpRangePercent_5	upper limit value of RMS of force pulse 6 (percentage)	Integer	0	50	
186	mpForceRmsUpRangePercent_6	upper limit value of RMS of force pulse 7 (percentage)	Integer	0	50	
187	mpForceRmsUpRangePercent_7	upper limit value of RMS of force pulse 8 (percentage)	Integer	0	50	
188	mpForceRmsUpRangePercent_8	upper limit value of RMS of force pulse 9 (percentage)	Integer	0	50	
189	mpForceRmsUpRangePercent_9	upper limit value of RMS of force pulse 10 (percentage)	Integer	0	50	

190	mpForceRmsDownRangePercent_0	lower limit value of RMS of force pulse 1 (percentage)	Integer	0	50	
191	mpForceRmsDownRangePercent_1	lower limit value of RMS of force pulse 2 (percentage)	Integer	0	50	
192	mpForceRmsDownRangePercent_2	lower limit value of RMS of force pulse 3 (percentage)	Integer	0	50	
193	mpForceRmsDownRangePercent_3	lower limit value of RMS of force pulse 4 (percentage)	Integer	0	50	
194	mpForceRmsDownRangePercent_4	lower limit value of RMS of force pulse 5 (percentage)	Integer	0	50	
195	mpForceRmsDownRangePercent_5	lower limit value of RMS of force pulse 6 (percentage)	Integer	0	50	
196	mpForceRmsDownRangePercent_6	lower limit value of RMS of force pulse 7 (percentage)	Integer	0	50	
197	mpForceRmsDownRangePercent_7	lower limit value of RMS of force pulse 8 (percentage)	Integer	0	50	
198	mpForceRmsDownRangePercent_8	lower limit value of RMS of force pulse 9 (percentage)	Integer	0	50	
199	mpForceRmsDownRangePercent_9	lower limit value of RMS of force pulse 10 (percentage)	Integer	0	50	
200	mpCurrentPeakUpRangePercent_0	upper limit value of peak of current pulse 1 (percentage)	Integer	0	50	
201	mpCurrentPeakUpRangePercent_1	upper limit value of peak of current pulse 2 (percentage)	Integer	0	50	
202	mpCurrentPeakUpRangePercent_2	upper limit value of peak of current pulse 3 (percentage)	Integer	0	50	
203	mpCurrentPeakUpRangePercent_3	upper limit value of peak of current pulse 4 (percentage)	Integer	0	50	
204	mpCurrentPeakUpRangePercent_4	upper limit value of peak of current pulse 5 (percentage)	Integer	0	50	
205	mpCurrentPeakUpRangePercent_5	upper limit value of peak of current pulse 6 (percentage)	Integer	0	50	
206	mpCurrentPeakUpRangePercent_6	upper limit value of peak of current pulse 7 (percentage)	Integer	0	50	
207	mpCurrentPeakUpRangePercent_7	upper limit value of peak of current pulse 8 (percentage)	Integer	0	50	
208	mpCurrentPeakUpRangePercent_8	upper limit value of peak of current pulse 9 (percentage)	Integer	0	50	
209	mpCurrentPeakUpRangePercent_9	upper limit value of peak of current pulse 10 (percentage)	Integer	0	50	
210	mpCurrentPeakDownRangePercent_0	lower limit value of peak of current pulse 1 (percentage)	Integer	0	50	

211	mpCurrentPeakDownRangePercent_1	lower limit value of peak of current pulse 2 (percentage)	Integer	0	50	
212	mpCurrentPeakDownRangePercent_2	lower limit value of peak of current pulse 3 (percentage)	Integer	0	50	
213	mpCurrentPeakDownRangePercent_3	lower limit value of peak of current pulse 4 (percentage)	Integer	0	50	
214	mpCurrentPeakDownRangePercent_4	lower limit value of peak of current pulse 5 (percentage)	Integer	0	50	
215	mpCurrentPeakDownRangePercent_5	lower limit value of peak of current pulse 6 (percentage)	Integer	0	50	
216	mpCurrentPeakDownRangePercent_6	lower limit value of peak of current pulse 7 (percentage)	Integer	0	50	
217	mpCurrentPeakDownRangePercent_7	lower limit value of peak of current pulse 8 (percentage)	Integer	0	50	
218	mpCurrentPeakDownRangePercent_8	lower limit value of peak of current pulse 9 (percentage)	Integer	0	50	
219	mpCurrentPeakDownRangePercent_9	lower limit value of peak of current pulse 10 (percentage)	Integer	0	50	
220	mpDisplacementRmsUpRangePercent_0	upper limit value of peak of displacement pulse 1 (percentage)	Integer	0	50	
221	mpDisplacementRmsUpRangePercent_1	upper limit value of peak of displacement pulse 2 (percentage)	Integer	0	50	
222	mpDisplacementRmsUpRangePercent_2	upper limit value of peak of displacement pulse 3 (percentage)	Integer	0	50	
223	mpDisplacementRmsUpRangePercent_3	upper limit value of peak of displacement pulse 4 (percentage)	Integer	0	50	
224	mpDisplacementRmsUpRangePercent_4	upper limit value of peak of displacement pulse 5 (percentage)	Integer	0	50	
225	mpDisplacementRmsUpRangePercent_5	upper limit value of peak of displacement pulse 6 (percentage)	Integer	0	50	
226	mpDisplacementRmsUpRangePercent_6	upper limit value of peak of displacement pulse 7 (percentage)	Integer	0	50	
227	mpDisplacementRmsUpRangePercent_7	upper limit value of peak of displacement pulse 8 (percentage)	Integer	0	50	
228	mpDisplacementRmsUpRangePercent_8	upper limit value of peak of displacement pulse 9 (percentage)	Integer	0	50	
229	mpDisplacementRmsUpRangePercent_9	upper limit value of peak of displacement pulse 10 (percentage)	Integer	0	50	
230	mpDisplacementRmsDownRangePercent_0	lower limit value of peak of displacement pulse 1 (percentage)	Integer	0	50	

231	mpDisplacementRmsDownRangePercent_1	lower limit value of peak of displacement pulse 2 (percentage)	Integer	0	50	
232	mpDisplacementRmsDownRangePercent_2	lower limit value of peak of displacement pulse 3 (percentage)	Integer	0	50	
233	mpDisplacementRmsDownRangePercent_3	lower limit value of peak of displacement pulse 4 (percentage)	Integer	0	50	
234	mpDisplacementRmsDownRangePercent_4	lower limit value of peak of displacement pulse 5 (percentage)	Integer	0	50	
235	mpDisplacementRmsDownRangePercent_5	lower limit value of peak of displacement pulse 6 (percentage)	Integer	0	50	
236	mpDisplacementRmsDownRangePercent_6	lower limit value of peak of displacement pulse 7 (percentage)	Integer	0	50	
237	mpDisplacementRmsDownRangePercent_7	lower limit value of peak of displacement pulse 8 (percentage)	Integer	0	50	
238	mpDisplacementRmsDownRangePercent_8	lower limit value of peak of displacement pulse 9 (percentage)	Integer	0	50	
239	mpDisplacementRmsDownRangePercent_9	lower limit value of peak of displacement pulse 10 (percentage)	Integer	0	50	
240	mpEnergyRmsUpRangePercent_0	upper limit value of RMS of energy pulse 1 (percentage)	Integer	0	50	
241	mpEnergyRmsUpRangePercent_1	upper limit value of RMS of energy pulse 2 (percentage)	Integer	0	50	
242	mpEnergyRmsUpRangePercent_2	upper limit value of RMS of energy pulse 3 (percentage)	Integer	0	50	
243	mpEnergyRmsUpRangePercent_3	upper limit value of RMS of energy pulse 4 (percentage)	Integer	0	50	
244	mpEnergyRmsUpRangePercent_4	upper limit value of RMS of energy pulse 5 (percentage)	Integer	0	50	
245	mpEnergyRmsUpRangePercent_5	upper limit value of RMS of energy pulse 6 (percentage)	Integer	0	50	
246	mpEnergyRmsUpRangePercent_6	upper limit value of RMS of energy pulse 7 (percentage)	Integer	0	50	
247	mpEnergyRmsUpRangePercent_7	upper limit value of RMS of energy pulse 8 (percentage)	Integer	0	50	
248	mpEnergyRmsUpRangePercent_8	upper limit value of RMS of energy pulse 9 (percentage)	Integer	0	50	
249	mpEnergyRmsUpRangePercent_9	upper limit value of RMS of energy pulse 10 (percentage)	Integer	0	50	
250	mpEnergyRmsDownRangePercent_0	lower limit value of RMS of energy pulse 1 (percentage)	Integer	0	50	

251	mpEnergyRmsDownRangePercent_1	lower limit value of RMS of energy pulse 2 (percentage)	Integer	0	50	
252	mpEnergyRmsDownRangePercent_2	lower limit value of RMS of energy pulse 3 (percentage)	Integer	0	50	
253	mpEnergyRmsDownRangePercent_3	lower limit value of RMS of energy pulse 4 (percentage)	Integer	0	50	
254	mpEnergyRmsDownRangePercent_4	lower limit value of RMS of energy pulse 5 (percentage)	Integer	0	50	
255	mpEnergyRmsDownRangePercent_5	lower limit value of RMS of energy pulse 6 (percentage)	Integer	0	50	
256	mpEnergyRmsDownRangePercent_6	lower limit value of RMS of energy pulse 7 (percentage)	Integer	0	50	
257	mpEnergyRmsDownRangePercent_7	lower limit value of RMS of energy pulse 8 (percentage)	Integer	0	50	
258	mpEnergyRmsDownRangePercent_8	lower limit value of RMS of energy pulse 9 (percentage)	Integer	0	50	
259	mpEnergyRmsDownRangePercent_9	lower limit value of RMS of energy pulse 10 (percentage)	Integer	0	50	
260	mpWeldTimeRmsUpRangePercent_0	upper limit value of RMS of welding time pulse 1 (percentage)	Integer	0	50	
261	mpWeldTimeRmsUpRangePercent_1	upper limit value of RMS of welding time pulse 2 (percentage)	Integer	0	50	
262	mpWeldTimeRmsUpRangePercent_2	upper limit value of RMS of welding time pulse 3 (percentage)	Integer	0	50	
263	mpWeldTimeRmsUpRangePercent_3	upper limit value of RMS of welding time pulse 4 (percentage)	Integer	0	50	
264	mpWeldTimeRmsUpRangePercent_4	upper limit value of RMS of welding time pulse 5 (percentage)	Integer	0	50	
265	mpWeldTimeRmsUpRangePercent_5	upper limit value of RMS of welding time pulse 6 (percentage)	Integer	0	50	
266	mpWeldTimeRmsUpRangePercent_6	upper limit value of RMS of welding time pulse 7 (percentage)	Integer	0	50	
267	mpWeldTimeRmsUpRangePercent_7	upper limit value of RMS of welding time pulse 8 (percentage)	Integer	0	50	
268	mpWeldTimeRmsUpRangePercent_8	upper limit value of RMS of welding time pulse 9 (percentage)	Integer	0	50	
269	mpWeldTimeRmsUpRangePercent_9	upper limit value of RMS of welding time pulse 10 (percentage)	Integer	0	50	
270	mpWeldTimeRmsDownRangePercent_0	lower limit value of RMS of welding time pulse 1 (percentage)	Integer	0	50	

271	mpWeldTimeRmsDownRangePercent_1	lower limit value of RMS of welding time pulse 2 (percentage)	Integer	0	50	
272	mpWeldTimeRmsDownRangePercent_2	lower limit value of RMS of welding time pulse 3 (percentage)	Integer	0	50	
273	mpWeldTimeRmsDownRangePercent_3	lower limit value of RMS of welding time pulse 4 (percentage)	Integer	0	50	
274	mpWeldTimeRmsDownRangePercent_4	lower limit value of RMS of welding time pulse 5 (percentage)	Integer	0	50	
275	mpWeldTimeRmsDownRangePercent_5	lower limit value of RMS of welding time pulse 6 (percentage)	Integer	0	50	
276	mpWeldTimeRmsDownRangePercent_6	lower limit value of RMS of welding time pulse 7 (percentage)	Integer	0	50	
277	mpWeldTimeRmsDownRangePercent_7	lower limit value of RMS of welding time pulse 8 (percentage)	Integer	0	50	
278	mpWeldTimeRmsDownRangePercent_8	lower limit value of RMS of welding time pulse 9 (percentage)	Integer	0	50	
279	mpWeldTimeRmsDownRangePercent_9	lower limit value of RMS of welding time pulse 10 (percentage)	Integer	0	50	
280	mpStartPeriod_0	the starting period of Pulse 1 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing.(For example, if the actual value is 5000.66, the value during communication will be 500066)
282	mpStartPeriod_1	the starting period of Pulse 2 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
284	mpStartPeriod_2	the starting period of Pulse 3 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

286	mpStartPeriod_3	the starting period of Pulse 4 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
288	mpStartPeriod_4	the starting period of Pulse 5 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
290	mpStartPeriod_5	the starting period of Pulse 6 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
292	mpStartPeriod_6	the starting period of Pulse 7 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
294	mpStartPeriod_7	the starting period of Pulse 8 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
296	mpStartPeriod_8	the starting period of Pulse 9 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
298	mpStartPeriod_9	the starting period of Pulse 10 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

300	mpEndPeriod_0	the ending period of Pulse 1 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
302	mpEndPeriod_1	the ending period of Pulse 2 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
304	mpEndPeriod_2	the ending period of Pulse 3 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
306	mpEndPeriod_3	the ending period of Pulse 4 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
308	mpEndPeriod_4	the ending period of Pulse 5 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
310	mpEndPeriod_5	the ending period of Pulse 6 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
312	mpEndPeriod_6	the ending period of Pulse 7 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

314	mpEndPeriod_7	the ending period of Pulse 8 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
316	mpEndPeriod_8	the ending period of Pulse 9 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
318	mpEndPeriod_9	the ending period of Pulse 10 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
320	mpTargetCurrentValue_0	the target RMS value of the current of Pulse 1 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
322	mpTargetCurrentValue_1	the target RMS value of the current of Pulse 2 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
324	mpTargetCurrentValue_2	the target RMS value of the current of Pulse 3 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
326	mpTargetCurrentValue_3	the target RMS value of the current of Pulse 4 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
328	mpTargetCurrentValue_4	the target RMS value of the current of Pulse 5 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
330	mpTargetCurrentValue_5	the target RMS value of the current of Pulse 6 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

332	mpTargetCurrentValue_6	the target RMS value of the current of Pulse 7 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
334	mpTargetCurrentValue_7	the target RMS value of the current of Pulse 8 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
336	mpTargetCurrentValue_8	the target RMS value of the current of Pulse 9 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
338	mpTargetCurrentValue_9	the target RMS value of the current of Pulse 10 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
340	mpCurrentPeakValue_0	the target peak value of the current of Pulse 1 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
342	mpCurrentPeakValue_1	the target peak value of the current of Pulse 2 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
344	mpCurrentPeakValue_2	the target peak value of the current of Pulse 3 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
346	mpCurrentPeakValue_3	the target peak value of the current of Pulse 4 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
348	mpCurrentPeakValue_4	the target peak value of the current of Pulse 5 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
350	mpCurrentPeakValue_5	the target peak value of the current of Pulse 6 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

352	mpCurrentPeakValue_6	the target peak value of the current of Pulse 7 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
354	mpCurrentPeakValue_7	the target peak value of the current of Pulse 8 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
356	mpCurrentPeakValue_8	the target peak value of the current of Pulse 9 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
358	mpCurrentPeakValue_9	the target peak value of the current of Pulse 10 (KA). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-1500	1500	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
360	mpTargetVoltageValue_0	the target RMS value of the voltage of Pulse 1 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
362	mpTargetVoltageValue_1	the target RMS value of the voltage of Pulse 2 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
364	mpTargetVoltageValue_2	the target RMS value of the voltage of Pulse 3 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
366	mpTargetVoltageValue_3	the target RMS value of the voltage of Pulse 4 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
368	mpTargetVoltageValue_4	the target RMS value of the voltage of Pulse 5 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
370	mpTargetVoltageValue_5	the target RMS value of the voltage of Pulse 6 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

372	mpTargetVoltageValue_6	the target RMS value of the voltage of Pulse 7 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
374	mpTargetVoltageValue_7	the target RMS value of the voltage of Pulse 8 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
376	mpTargetVoltageValue_8	the target RMS value of the voltage of Pulse 9 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
378	mpTargetVoltageValue_9	the target RMS value of the voltage of Pulse 10 (V). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-80	80	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
380	mpUpDisplacementValue_0	the upper displacement settlement value of Pulse 1 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
382	mpUpDisplacementValue_1	the upper displacement settlement value of Pulse 2 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
384	mpUpDisplacementValue_2	the upper displacement settlement value of Pulse 3 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
386	mpUpDisplacementValue_3	the upper displacement settlement value of Pulse 4 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
388	mpUpDisplacementValue_4	the upper displacement settlement value of Pulse 5 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
390	mpUpDisplacementValue_5	the upper displacement settlement value of Pulse 6 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

392	mpUpDisplacementValue_6	the upper displacement settlement value of Pulse 7 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
394	mpUpDisplacementValue_7	the upper displacement settlement value of Pulse 8 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
396	mpUpDisplacementValue_8	the upper displacement settlement value of Pulse 9 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
398	mpUpDisplacementValue_9	the upper displacement settlement value of Pulse 10 (mm). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
400	mpDownDisplacementValue_0	the lower displacement collapse value of Pulse 1 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
402	mpDownDisplacementValue_1	the lower displacement collapse value of Pulse 2 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
404	mpDownDisplacementValue_2	the lower displacement collapse value of Pulse 3 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
406	mpDownDisplacementValue_3	the lower displacement collapse value of Pulse 4 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
408	mpDownDisplacementValue_4	the lower displacement collapse value of Pulse 5 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
410	mpDownDisplacementValue_5	the lower displacement collapse value of Pulse 6 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

412	mpDownDisplacementValue_6	the lower displacement collapse value of Pulse 7 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
414	mpDownDisplacementValue_7	the lower displacement collapse value of Pulse 8 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
416	mpDownDisplacementValue_8	the lower displacement collapse value of Pulse 9 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
418	mpDownDisplacementValue_9	the lower displacement collapse value of Pulse 10 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	-2000	2000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
420	mpTargetResValue_0	the target RMS value of the resistance of Pulse 1 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
422	mpTargetResValue_1	the target RMS value of the resistance of Pulse 2 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
424	mpTargetResValue_2	the target RMS value of the resistance of Pulse 3 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
426	mpTargetResValue_3	the target RMS value of the resistance of Pulse 4 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
428	mpTargetResValue_4	the target RMS value of the resistance of Pulse 5 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
430	mpTargetResValue_5	the target RMS value of the resistance of Pulse 6 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

432	mpTargetResValue_6	the target RMS value of the resistance of Pulse 7 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
434	mpTargetResValue_7	the target RMS value of the resistance of Pulse 8 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
436	mpTargetResValue_8	the target RMS value of the resistance of Pulse 9 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
438	mpTargetResValue_9	the target RMS value of the resistance of Pulse 10 (μΩ) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	-999999	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
440	mpTargetForceValue_0	the target RMS value of the force of Pulse 1 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
442	mpTargetForceValue_1	the target RMS value of the force of Pulse 2 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
444	mpTargetForceValue_2	the target RMS value of the force of Pulse 3 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
446	mpTargetForceValue_3	the target RMS value of the force of Pulse 4 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
448	mpTargetForceValue_4	the target RMS value of the force of Pulse 5 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

450	mpTargetForceValue_5	the target RMS value of the force of Pulse 6 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
452	mpTargetForceValue_6	the target RMS value of the force of Pulse 7 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
454	mpTargetForceValue_7	the target RMS value of the force of Pulse 8 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
456	mpTargetForceValue_8	the target RMS value of the force of Pulse 9 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
458	mpTargetForceValue_9	the target RMS value of the force of Pulse 10 (the force units include KN, LBF, KGF) .occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits.	FLOAT	0	50000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
460	mpTargetEnergyValue_0	the target energy value of Pulse 1 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
462	mpTargetEnergyValue_1	the target energy value of Pulse 2 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
464	mpTargetEnergyValue_2	the target energy value of Pulse 3 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
466	mpTargetEnergyValue_3	the target energy value of Pulse 4 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
468	mpTargetEnergyValue_4	the target energy value of Pulse 5 (J). occupies 2 addresses. This address is the upper 16 bits, and the	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to

		next address is the lower 16 bits				divide the data by 100 during data processing
470	mpTargetEnergyValue_5	the target energy value of Pulse 6 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
472	mpTargetEnergyValue_6	the target energy value of Pulse 7 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
474	mpTargetEnergyValue_7	the target energy value of Pulse 8 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
476	mpTargetEnergyValue_8	the target energy value of Pulse 9 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
478	mpTargetEnergyValue_9	the target energy value of Pulse 10 (J). occupies 2 addresses. This address is the upper 16 bits, and the next address is the lower 16 bits	FLOAT	0	999999	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
480	mpTargetWeldTime_0	the target value of the welding time of Pulse 1 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
482	mpTargetWeldTime_1	the target value of the welding time of Pulse 2 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
484	mpTargetWeldTime_2	the target value of the welding time of Pulse 3 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits,	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

		and the next address is the lower 16 bits)				
486	mpTargetWeldTime_3	the target value of the welding time of Pulse 4 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
488	mpTargetWeldTime_4	the target value of the welding time of Pulse 5 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
490	mpTargetWeldTime_5	the target value of the welding time of Pulse 6 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
492	mpTargetWeldTime_6	the target value of the welding time of Pulse 7 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
494	mpTargetWeldTime_7	the target value of the welding time of Pulse 8 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
496	mpTargetWeldTime_8	the target value of the welding time of Pulse 9 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing

498	mpTargetWeldTime_9	the target value of the welding time of Pulse 10 (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	FLOAT	0	5000	when reading and writing data during communication, the data is amplified by 100 times, and it is necessary to divide the data by 100 during data processing
500	mpProgramName	reserve				
534	mpCustomFiled1	reserve				
568	mpCustomFiled2	reserve				
602	mpCustomFiled3	reserve				
636	mpCustomFiled4	reserve				
670	mpCustomFiled5	reserve				
704	mpReserve704	reserve				
1199	mReserveProgramMax	reserve				

Table 78: Program Parameter Communication Structure

10.1.2.1 Alarm Settings Message

The Alarm Settings are defined in two bytes. The second byte map for the mpAlarmSettings1 and mpAlarmSettings2 are defined in Table 79.

Absolute address First Bit	Address Name	Second Bit	Alarm Switch Bit
27	mpAlarmSettings1	0	the main alarm switch
		1	the main switch for current - type alarms
		2	the main switch for voltage - type alarms
		3	the main switch for pressure - type alarms
		4	the main switch for resistance - type alarms
		5	the main switch for displacement - type alarms
		6	welding time alarm switch
		7	energy alarm switch
		8	current upper and lower limit alarm switch
		9	current envelope alarm switch
		10	current peak value alarm switch
		11	resistance upper and lower limit alarm switch
		12	resistance envelope alarm switch
		13	voltage upper and lower limit alarm switch
		14	displacement upper and lower limit alarm switch
		15	displacement envelope alarm switch
28	mpAlarmSettings2	0	pressure upper and lower limit alarm switch
		1	pressure envelope alarm switch
		2	reserve

		3	reserve
		4	reserve
		5	reserve
		6	reserve
		7	reserve
		8	reserve
		9	reserve
		10	reserve
		11	reserve
		12	reserve
		13	reserve
		14	reserve
		15	reserve

Table 79: Program Parameter - Alarm Settings Communication Structure

10.1.3 Display Parameters

The Modbus Master (PLC or the other Modbus devices) can read the display parameters using Function Code 03. The addresses of the data are defined in Table 80. The alarm status for the second word of the messages are defined in Table 81.

Absolute address	Address Name	Address Description	Data Type	Min Value	Max Data	Explanation of Data Value Definition
1900	mdWork_Mode	current working mode	Integer	0	4	0: Reset mode 1: Detection mode 2: Calibration mode 3: Envelope mode 4: Prohibition mode
1901	mdWork_Status	current working status	Integer	0	1	0: Monitor 1: Hold
1902	mdCount_Spots	the number of welding points. Occupies 2 addresses (This address is the upper 16 bits, and the next address is the lower 16 bits)	Integer	0	2^31	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1904	mdAlarm_Status	alarm status	Integer	0	65536	please refer to the alarm bit address table for details.
1905	mdAlarm_Status2	alarm status 2	Integer	0	65536	please refer to the alarm bit address table for details.
1906	mdAlarm_Status3	alarm status 3	Integer	0	65536	please refer to the alarm bit address table for details.
1907	mdAlarm_Status4	alarm status 4	Integer	0	65536	please refer to the alarm bit address table for details.
1908	mdAlarm_Status5	alarm status 5	Integer	0	65536	please refer to the alarm bit address table for details.
1909	mdAlarm_Status6	alarm status 6	Integer	0	65536	please refer to the alarm bit address table for details.

1910	mdAlarm_Status7	alarm status 7	Integer	0	65536	please refer to the alarm bit address table for details.
1911	mdAlarm_Status8	alarm status 8	Integer	0	65536	please refer to the alarm bit address table for details.
1912	mdAlarm_Status9	alarm status 9	Integer	0	65536	please refer to the alarm bit address table for details.
1913	mdAlarm_Status10	alarm status 10	Integer	0	65536	please refer to the alarm bit address table for details.
1914	mdReserver1914	reserve address				
1915	mdReserver1915	reserve address				
1916	mdRMS_Current_1	the RMS value of current pulse 1 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.(For example, if the actual value is 5000.66, the value during communication will be 500066)
1918	mdRMS_Current_2	the RMS value of current pulse 2 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1920	mdRMS_Current_3	the RMS value of current pulse 3 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1922	mdRMS_Current_4	the RMS value of current pulse 4 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1924	mdRMS_Current_5	the RMS value of current pulse 5 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1926	mdRMS_Current_6	the RMS value of current pulse 6 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1928	mdRMS_Current_7	the RMS value of current pulse 7 (KA) .occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1930	mdRMS_Current_8	the RMS value of current pulse 8 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1932	mdRMS_Current_9	the RMS value of current pulse 9 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1934	mdRMS_Current_10	the RMS value of current pulse 10 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When

						processing the data, it is necessary to divide the data by 100.
1936	mdPeak_Current_1	the peak value of current pulse 1 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1938	mdPeak_Current_2	the peak value of current pulse 2 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1940	mdPeak_Current_3	the peak value of current pulse 3 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1942	mdPeak_Current_4	the peak value of current pulse 4 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1944	mdPeak_Current_5	the peak value of current pulse 5 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1946	mdPeak_Current_6	the peak value of current pulse 6 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1948	mdPeak_Current_7	the peak value of current pulse 7 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1950	mdPeak_Current_8	the peak value of current pulse 8 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1952	mdPeak_Current_9	the peak value of current pulse 9 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1954	mdPeak_Current_10	the peak value of current pulse 10 (KA). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1956	mdRMS_Voltage_1	the RMS value of voltage pulse 1 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1958	mdRMS_Voltage_2	the RMS value of voltage pulse 2 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.

1960	mdRMS_Voltage_3	the RMS value of voltage pulse 3 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1962	mdRMS_Voltage_4	the RMS value of voltage pulse 4 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1964	mdRMS_Voltage_5	the RMS value of voltage pulse 5 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1966	mdRMS_Voltage_6	the RMS value of voltage pulse 6 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1968	mdRMS_Voltage_7	the RMS value of voltage pulse 7 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1970	mdRMS_Voltage_8	the RMS value of voltage pulse 8 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1972	mdRMS_Voltage_9	the RMS value of voltage pulse 9 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1974	mdRMS_Voltage_10	the RMS value of voltage pulse 10 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1976	mdPeak_Voltage_1	the peak value of voltage pulse 1 (V) .occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1978	mdPeak_Voltage_2	the peak value of voltage pulse 2 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1980	mdPeak_Voltage_3	the peak value of voltage pulse 3 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1982	mdPeak_Voltage_4	the peak value of voltage pulse 4 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1984	mdPeak_Voltage_5	the peak value of voltage pulse 5 (V). occupies 2 addresses (this address is the	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be

		upper 16 bits, and the next address is the lower 16 bits)				amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1986	mdPeak_Voltage_6	the peak value of voltage pulse 6 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1988	mdPeak_Voltage_7	the peak value of voltage pulse 7 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1990	mdPeak_Voltage_8	the peak value of voltage pulse 8 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1992	mdPeak_Voltage_9	the peak value of voltage pulse 9 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1994	mdPeak_Voltage_10	the peak value of voltage pulse 10 (V). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
1996	mdTime_Weld_1	pulse 1 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.(For example, if the actual value is 5000, the value during communication will be 500000)
1998	mdTime_Weld_2	pulse 2 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2000	mdTime_Weld_3	pulse 3 welding time (When the measure type is DC or energy , the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2002	mdTime_Weld_4	pulse 4 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2004	mdTime_Weld_5	pulse 5 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2006	mdTime_Weld_6	pulse 6 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When

		unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)				processing the data, it is necessary to divide the data by 100.
2008	mdTime_Weld_7	pulse 7 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2010	mdTime_Weld_8	pulse 8 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2012	mdTime_Weld_9	pulse 9 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2014	mdTime_Weld_10	pulse 10 welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2016	mdTime_Weld_All	total welding time (When the measure type is DC or CD, the unit is ms; when the measure type is AC, the unit is cyc). It occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2018	mdRMS_Power_1	the energy value of pulse 1 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2020	mdRMS_Power_2	the energy value of pulse 2 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2022	mdRMS_Power_3	the energy value of pulse 3 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2024	mdRMS_Power_4	the energy value of pulse 4 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2026	mdRMS_Power_5	the energy value of pulse 5 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2028	mdRMS_Power_6	the energy value of pulse 6 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When

						processing the data, it is necessary to divide the data by 100.
2030	mdRMS_Power_7	the energy value of pulse 7 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2032	mdRMS_Power_8	the energy value of pulse 8 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2034	mdRMS_Power_9	the energy value of pulse 9 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2036	mdRMS_Power_10	the energy value of pulse 10 (J). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2038	mdRMS_Resistance_1	the RMS value of resistance pulse 1 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2040	mdRMS_Resistance_2	the RMS value of resistance pulse 2 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2042	mdRMS_Resistance_3	the RMS value of resistance pulse 3 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2044	mdRMS_Resistance_4	the RMS value of resistance pulse 4 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2046	mdRMS_Resistance_5	the RMS value of resistance pulse 5 (μΩ) .occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2048	mdRMS_Resistance_6	the RMS value of resistance pulse 6 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2050	mdRMS_Resistance_7	the RMS value of resistance pulse 7 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2052	mdRMS_Resistance_8	the RMS value of resistance pulse 8 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.

2054	mdRMS_Resistance_9	the RMS value of resistance pulse 9 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2056	mdRMS_Resistance_10	the RMS value of resistance pulse 10 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2058	mdPeak_Resistance_1	the peak value of resistance pulse 1 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2060	mdPeak_Resistance_2	the peak value of resistance pulse 2 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2062	mdPeak_Resistance_3	the peak value of resistance pulse 3 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2064	mdPeak_Resistance_4	the peak value of resistance pulse 4 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2066	mdPeak_Resistance_5	the peak value of resistance pulse 5 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2068	mdPeak_Resistance_6	the peak value of resistance pulse 6 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2070	mdPeak_Resistance_7	the peak value of resistance pulse 7 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2072	mdPeak_Resistance_8	the peak value of resistance pulse 8 (μΩ) .occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2074	mdPeak_Resistance_9	the peak value of resistance pulse 9 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2076	mdPeak_Resistance_10	the peak value of resistance pulse 10 (μΩ). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2078	mdRMS_Force_1	the RMS value of force pulse 1 (the force units include (KN, LBF, KGF)).	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be

		occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)				amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2080	mdRMS_Force_2	the RMS value of force pulse 2 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2082	mdRMS_Force_3	the RMS value of force pulse 3 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2084	mdRMS_Force_4	the RMS value of force pulse 4 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2086	mdRMS_Force_5	the RMS value of force pulse 5 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2088	mdRMS_Force_6	the RMS value of force pulse 6 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2090	mdRMS_Force_7	the RMS value of force pulse 7 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2092	mdRMS_Force_8	the RMS value of force pulse 8 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2094	mdRMS_Force_9	the RMS value of force pulse 9 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2096	mdRMS_Force_10	the RMS value of force pulse 10 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2098	mdPeak_Force_1	the peak value of force pulse 1 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2100	mdPeak_Force_2	the peak value of force pulse 2 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2102	mdPeak_Force_3	the peak value of force pulse 3 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When

		upper 16 bits, and the next address is the lower 16 bits)				processing the data, it is necessary to divide the data by 100.
2104	mdPeak_Force_4	the peak value of force pulse 4 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2106	mdPeak_Force_5	the peak value of force pulse 5 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2108	mdPeak_Force_6	the peak value of force pulse 6 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2110	mdPeak_Force_7	the peak value of force pulse 7 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2112	mdPeak_Force_8	the peak value of force pulse 8 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2114	mdPeak_Force_9	the peak value of force pulse 9 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2116	mdPeak_Force_10	the peak value of force pulse 10 (the force units include (KN, LBF, KGF)). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2118	mdRMS_Displacement_1	the welding melt-in value of the upper displacement pulse 1 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2120	mdRMS_Displacement_2	the welding melt-in value of the upper displacement pulse 2 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2122	mdRMS_Displacement_3	the welding melt-in value of the upper displacement pulse 3 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2124	mdRMS_Displacement_4	the welding melt-in value of the upper displacement pulse 4 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2126	mdRMS_Displacement_5	the welding melt-in value of the upper displacement pulse 5 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.

2128	mdRMS_Displacement_6	the welding melt-in value of the upper displacement pulse 6 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2130	mdRMS_Displacement_7	the welding melt-in value of the upper displacement pulse 7 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2132	mdRMS_Displacement_8	the welding melt-in value of the upper displacement pulse 8 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2134	mdRMS_Displacement_9	the welding melt-in value of the upper displacement pulse 9 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2136	mdRMS_Displacement_10	the welding melt-in value of the upper displacement pulse 10 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2138	mdPeak_Displacement_1	the peak value of upper displacement pulse 1(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2140	mdPeak_Displacement_2	the peak value of upper displacement pulse 2(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2142	mdPeak_Displacement_3	the peak value of upper displacement pulse 3(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2144	mdPeak_Displacement_4	the peak value of upper displacement pulse 4(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2146	mdPeak_Displacement_5	the peak value of upper displacement pulse 5(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2148	mdPeak_Displacement_6	the peak value of upper displacement pulse 6(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2150	mdPeak_Displacement_7	the peak value of upper displacement pulse 7(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2152	mdPeak_Displacement_8	the peak value of upper displacement pulse 8(mm). occupies 2 addresses (this	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be

		address is the upper 16 bits, and the next address is the lower 16 bits)				amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2154	mdPeak_Displacement_9	the peak value of upper displacement pulse 9(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2156	mdPeak_Displacement_10	the peak value of upper displacement pulse 10(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2158	mdRMS_DownDisplacement_1	the welding melt-in value of the lower displacement pulse 1 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2160	mdRMS_DownDisplacement_2	the welding melt-in value of the lower displacement pulse 2 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2162	mdRMS_DownDisplacement_3	the welding melt-in value of the lower displacement pulse 3 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2164	mdRMS_DownDisplacement_4	the welding melt-in value of the lower displacement pulse 4 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2166	mdRMS_DownDisplacement_5	the welding melt-in value of the lower displacement pulse 5 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2168	mdRMS_DownDisplacement_6	the welding melt-in value of the lower displacement pulse 6 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2170	mdRMS_DownDisplacement_7	the welding melt-in value of the lower displacement pulse 7 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2172	mdRMS_DownDisplacement_8	the welding melt-in value of the lower displacement pulse 8 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2174	mdRMS_DownDisplacement_9	the welding melt-in value of the lower displacement pulse 9 (mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2176	mdRMS_DownDisplacement_10	the welding melt-in value of the lower displacement pulse 10 (mm). occupies 2 addresses (this address is the upper 16	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When

		bits, and the next address is the lower 16 bits)				processing the data, it is necessary to divide the data by 1000.
2178	mdPeak_DownDisplacement_1	the peak value of lower displacement pulse 1(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2180	mdPeak_DownDisplacement_2	the peak value of lower displacement pulse 2(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2182	mdPeak_DownDisplacement_3	the peak value of lower displacement pulse 3(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2184	mdPeak_DownDisplacement_4	the peak value of lower displacement pulse 4(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2186	mdPeak_DownDisplacement_5	the peak value of lower displacement pulse 5(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2188	mdPeak_DownDisplacement_6	the peak value of lower displacement pulse 6(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2190	mdPeak_DownDisplacement_7	the peak value of lower displacement pulse 7(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2192	mdPeak_DownDisplacement_8	the peak value of lower displacement pulse 8(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2194	mdPeak_DownDisplacement_9	the peak value of lower displacement pulse 9(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2196	mdPeak_DownDisplacement_10	the peak value of lower displacement pulse 10(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2198	mdTime_Tp_1	the peak time of pulse 1 in CD welding(ms). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2200	mdTime_Tp_2	the peak time of pulse 2 CD welding(ms). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.

2202	mdTime_Tp_3	the peak time of pulse 3 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2204	mdTime_Tp_4	the peak time of pulse 4 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2206	mdTime_Tp_5	the peak time of pulse 5 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2208	mdTime_Tp_6	the peak time of pulse 6 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2210	mdTime_Tp_7	the peak time of pulse 7 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2212	mdTime_Tp_8	the peak time of pulse 8 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2214	mdTime_Tp_9	the peak time of pulse 9 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2216	mdTime_Tp_10	the peak time of pulse 10 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2218	mdTime_Th_1	the half-peak time of pulse 1 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2220	mdTime_Th_2	the half-peak time of pulse 2 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2222	mdTime_Th_3	the half-peak time of pulse 3 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2224	mdTime_Th_4	the half-peak time of pulse 4 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2226	mdTime_Th_5	the half-peak time of pulse 5 in CD welding(ms).occupies 2 addresses (this	Fraction	0	5000	When reading and writing data during communication, the data should be

		address is the upper 16 bits, and the next address is the lower 16 bits)				amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2228	mdTime_Th_6	the half-peak time of pulse 6 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2230	mdTime_Th_7	the half-peak time of pulse 7 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2232	mdTime_Th_8	the half-peak time of pulse 8 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2234	mdTime_Th_9	the half-peak time of pulse 9 in CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2236	mdTime_Th_10	the half-peak time of pulse 10 CD welding(ms).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	0	5000	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2238-2259	Reserved	It is for internal testing purposes and cannot be read and write.				
2260	mdRMS_Power_All	the RMS value of total welding energy (J).occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Integer	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2262	mdCraftCompletedCount	record the number of completed welds in the mode of weld point workpiece number	Fraction	0	50	
2263	mdReserve2253	reserve address				
2264	mdReserve2254	reserve address				
2265	mdUpDisplaceMeltValue	the welding melt-in value of the upper displacement(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2267	mdDownDisplaceMeltValue	the welding melt-in value of the lower displacement(mm). occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Fraction	-2^29	2^29	When reading and writing data during communication, the data should be amplified by 1000 times. When processing the data, it is necessary to divide the data by 1000.
2269	mdQualifiedCount	qualified measurement count. Occupies 2 addresses (this address is the upper 16 bits, and the next address is the lower 16 bits)	Integer	0	2^31	When reading and writing data during communication, the data should be amplified by 100 times. When processing the data, it is necessary to divide the data by 100.
2271	mdCount_Weld	number of welding current pulses	Integer	0	10	
2272	mdType_Machine	measure type	Integer	0	2	0:Medium-frequency direct current (for short:DC) 1:Alternating current (for short:AC) 2:Energy storage (for short: Energy)

Table 80: Display Parameters Communication Structure

10.1.3.1 Alarm Status Message

The Alarm Status is defined in two bytes. The second byte map for the mdAlarm_Status and mdAlarm_Status are defined in Table 81.

Absolute address First Bit	Address Name	Second Bit	Alarm Stus Bit
1904	mdAlarm_Status	0	reserve
		1	reserve
		2	reserve
		3	reserve
		4	reserve
		5	reserve
		6	welding time alarm
		7	energy alarm
		8	current upper and lower limit alarm
		9	current envelope alarm
		10	current peak value alarm
		11	resistance upper and lower limit alarm
		12	resistance envelope alarm
		13	voltage upper and lower limit alarm
		14	displacement upper and lower limit alarm
		15	displacement envelope alarm
1905	mdAlarm_Status2	0	pressure upper and lower limit alarm
		1	pressure envelope alarm
		2	envelope curve reading failed
		3	pulse mode mismatch
		4	pulse number mismatch
		5	reserve
		6	designated pulse number mismatch
		7	trigger mode mismatch
		8	measurement type mismatch
		9	reserve
		10	reserve
		11	reserve
		12	reserve
		13	reserve
		14	reserve
		15	reserve

Table 81: Display Settings- Alarm Status Communication Structure

10.2 Ethernet Communication

After each measurement is completed, the device can send all the measurement data of recorded weld to a HTTP server in real-time via the network. The **WRITE** is performed with a POST API call. The dataset is a predefined summary of the weld performed by. The dataset is in JSON format. The end user is responsible for managing the data on the server that the Hi5 Monitor is connected to.

The server location that each weld record is posted to is defined in the **https address** field found in the Communication Setup page. The Communication Setup page can be accessed by tapping **SYSTEM SETUP** then **COMM SET** in the footer menus.

The Hi5 Monitor can connect to the network via Ethernet or with 4G Network.

> **4G Network**
> The 4G Network option must be specified at the time of order and is configured by the manufacturer.

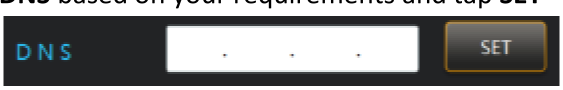
10.2.1 Ethernet Network Setup Instructions

The instructions for setting up and configuring the Ethernet communication are defined below.

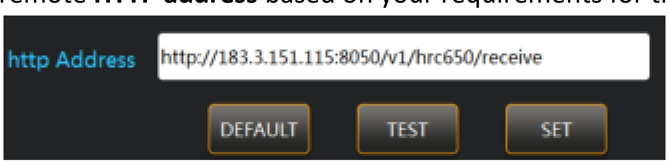
1. Connect the Hi5 Monitor to the internal network via the Ethernet port
2. From the Measure page, navigate to the Network Settings page by taping **SYSTEM SETUP** -> **COMM SET** on the footer menus
3. Set the Network Type to **Ethernet**
4. Set the **IP Address** of the Hi5 Monitor based on your requirements and tap **SET**

5. Set the Default **Gateway** based on your requirements and tap **SET**

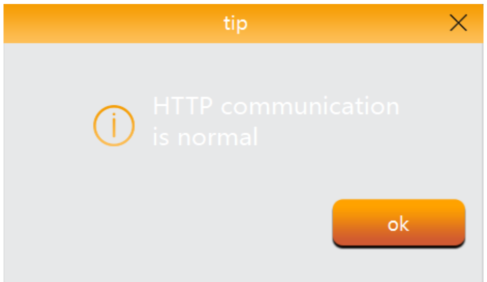
6. Set the **DNS** based on your requirements and tap **SET**



7. Set the remote **HTTP address** based on your requirements for the Hi5 Monitor. Then tap **SET**.

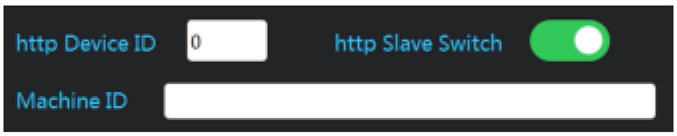


8. Test the HTTP connection by tapping the **TEST** icon
   i. If the prompt indicates that the communication is normal, it means the communication configuration is correct.



ii. If the prompt indicates that the communication is abnormal, after checking that the HTTP address and IP address information are correct, power off and restart the Hi5 Monitor device before testing again.

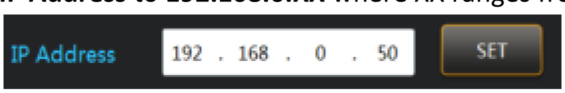
9. Turn the **HTTP slave switch** to enable the device to write each weld recorded to the server location defined in the http address



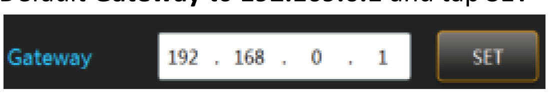
10.2.2 4G Router Setup Instructions

The instructions to setup communication via a 4G router are defined below.

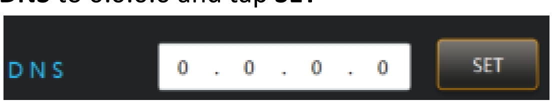
1. From the Measure page, navigate to the Network Settings page by taping **SYSTEM SETUP** -> **COMM SET** on the footer menus
2. Set the Network Type to **Ethernet**
3. Set the **IP Address** to **192.168.0.XX** where XX ranges from 2 to 250 and tap **SET**



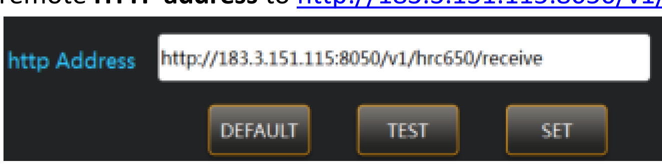
4. Set the Default **Gateway** to **192.169.0.1** and tap **SET**



5. Set the **DNS** to 0.0.0.0 and tap **SET**



6. Set the remote **HTTP address** to http://183.3.151.115:8050/v1/hrc650/receive then tap **SET**.



11 TUTORIALS

Placeholder for future tutorials.

12 TERMINOLOGY

Term	Meaning
Analog	Analog signals are continuous electrical signals such as voltage or current that are directly proportional to the input. They can be used to measure physical quantities such as force, displacement, or current.
CD	CD stands for capacitive discharge. Capacitive Discharge is a fast resistance welding process that stores electrical energy in capacitors and then releases it in a short, high-current pulse.
Displacement	Displacement is the net change in an object's position, calculated as the distance from its starting point (initial position) to its ending point (final position), including direction.
Encoder	A device that converts information from one format or code to another to make it easier for machines to read. For example, an encoder may translate physical motion or position into digital data.
Envelope	An envelope is an upper and lower boundary or limit for a measured signal over a period of time.
Force	Force is the mechanical pressure applied to the workpieces from the electrodes. Force is a key control parameter in resistance welding. The weld force correlates with the resistance across the workpiece interfaces and thus heat.
MFDC	MFDC stands for Medium Frequency Direct Current. MFDC is a welding process where AC power is converted in to higher frequencies and then rectified into DC current.
Pulse	A Pulse or Weld Pulse is an output of current from the weld control for a specified period of time. Pulses can be used to input energy into the weld in discrete steps. Pulses can be used to pre-heat materials, grow the weld nugget after the molten pool has formed, or temper the material during cooling.
RMS	A mathematical calculation for finding the average magnitude of varying quantities, especially when values can be positive or negative, by taking the square root of the average of the squared values. it represents the equivalent DC value for AC signals and is used in physics and engineering for power calculations and measuring signal strength.
Secondary Resistance	Secondary resistance measured by the Hi5 Weld Monitor is the total resistance between the upper and lower electrodes.
Toroid	A doughnut shaped tubular device used for measuring high currents based on the principle of electromagnetic induction.

13 RELATED DOCUMENTATION

#	Document Title	Version #	Location	Author