AUTOMATION
P R O D U C T S
GROUP, INC.

Operator's Manual

MND

Modbus Network Display

DOC. 9003708
Rev. A1, 5/14

APG.

Table of Contents

• Warranty and Warranty Restrictions

APG warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment found defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within 24 months from date of shipment from factory.

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Display Wiring

4 Conductor Cable

	No Outputs	Switched Voltage Source	4-20 mA
V+	*Red		Red
V- (com)	*Black	Black	
RS-485 A	White	White	White
RS-485 B	Green	Green	Green
‡Switched Source		Red	
4-20 mA			Black

*no connection on internal battery powered option

‡ refer to Switched Power Source description on page 16 for more information

5 Conductor Cable

	0-5 Vdc
V+	Red
V- (com)	Black
RS-485 A	White
RS-485 B	Green
0-5 Vdc	Orange
4-20 mA	

8 Conductor Cable

	(2) SS Relays	0-5 Vdc + (2) SS
V+	Red	Red
V- (com)	Black	Black
RS-485 A	White	White
RS-485 B	Green	Green
SS Relay 1	Yellow	Yellow
SS Relay 1	Orange	Blue
SS Relay 2	Blue	(shared common)
SS Relay 2	Brown	Brown
0-5 Vdc		Orange

5 Pin Micro-Connector
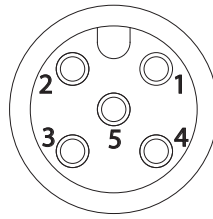
1 = Brown
2 = White
3 = Blue
4 = Black
5 = Grey

	No Outputs	‡Switched Power Source	4-20 mA	0-5 Vdc
V+	*Pin 1 (brown)		Pin 1 (brown)	Pin 1 (brown)
V- (com)	*Pin 3 (blue)	Pin 3 (blue)		Pin 3 (blue)
RS-845 A	Pin 2 (white)	Pin 2 (white)	Pin 2 (white)	Pin 2 (white)
RS-485 B	Pin 4 (black)	Pin 4 (black)	Pin 4 (black)	Pin 4 (black)
Switch Source		Pin 1 (brown)		
0-5 Vdc				Pin 5 (grey)
4-20 mA			Pin 3 (blue)	

*no connection for internal battery powered option
‡refer to page X for more information

8 Pin Micro-Connector
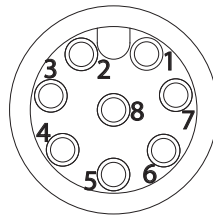
Pin 1 = White
Pin 2 = Brown
Pin 3 = Green
Pin 4 = Yellow
Pin 5 = Grey
Pin 6 = Pink
Pin 7 = Blue
Pin 8 = Red

	(2) SS Relays	0-5 Vdc + 2 Solid State Relays
V+	Pin 2 (brown)	Pin 2 (brown)
V- (com)	Pin 7 (blue)	Pin 7 (blue)
RS-485 A	Pin 1 (white)	Pin 1 (white)
RS-485 B	Pin 3 (green)	Pin 3 (green)
SS Relay 1	Pin 4 (yellow)	Pin 4 (yellow)
SS Relay 1	Pin 5 (grey)	Pin 5 (grey) shared common
SS Relay 2	Pin 6 (pink)	
SS Relay 2	Pin 8 (red)	Pin 6 (pink)
0-5 V		Pin 8 (red)

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Using the MND

Output Status Indicator   Scalable Bar Graph

Battery Meter

Increase Button   Enter Button

Decrease/Power Button

Increase Button

Function in Operating Mode: cycles through sensor readings when setup to display multiple sensors readings.

Function within Setup Menu: press to cycle upward through menu options or to increase mode setting values.

Decrease/Power Button

Function in Operating Mode: press and hold for 1 second to power on or off the MND.

Function within Setup Menu: press to cycle downward through menu options or decrease mode setting values.

Enter Button

Function in Operating Mode: cycles between the current, maximum, and minimum readings.

Function within Setup Menu: press to enter into the selected menu or to accept a setting option within a menu.

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*Access Modes

The MND has several operating modes which will limit or lock access to the setup menus. Refer to the mode descriptions at the bottom of the page for more information. To access the operating mode setting, follow the steps below.
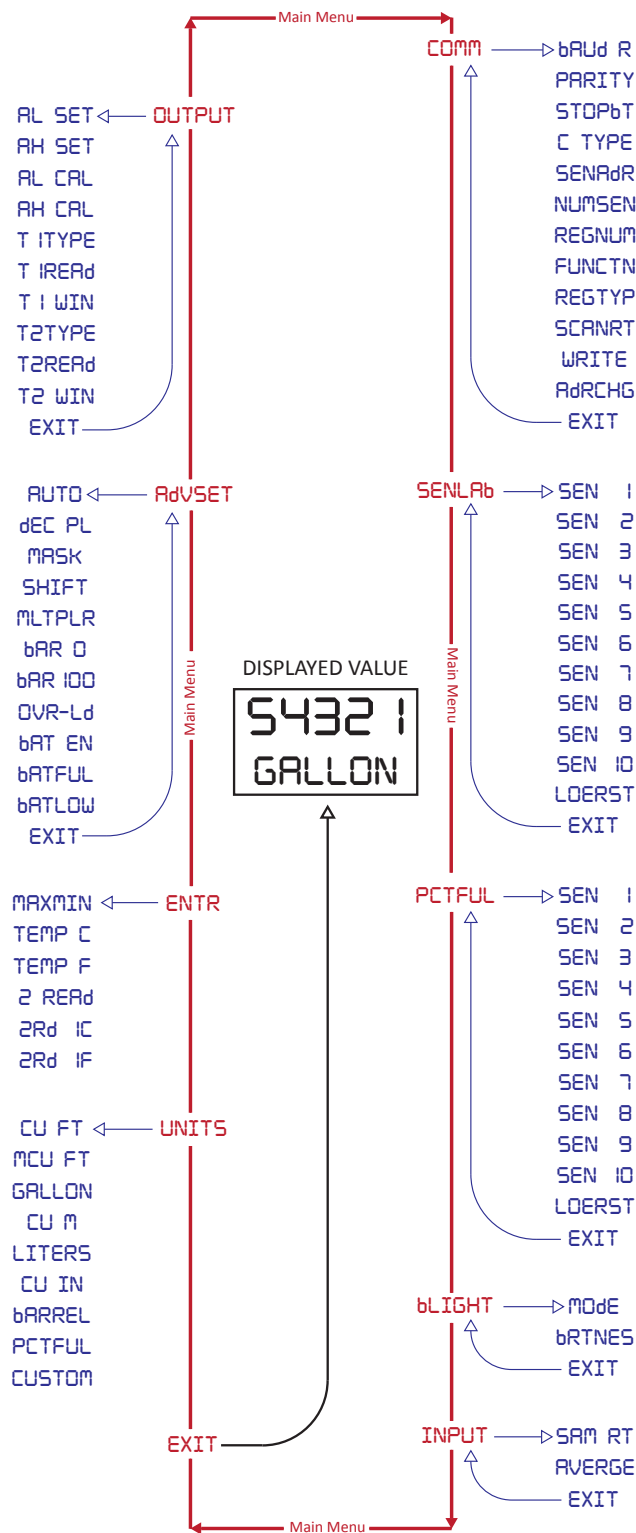
Step 1:   Simultaneously press and hold the Decrease button and the Enter button for approximately 5 seconds to bring up the *3 digit mode access number.

Step 2:   Use the Increase/Decrease buttons to change the value of he flashing digit, and Enter button to accept the value and advance to the next digit. The mode options are as follows:

Mode	Description
000	Full Access. All menu options are accessible, including those that may not be applicable to all MND configurations.
001	Locks access to all setup menus. The Increase Button will scroll through sensor readings when the MND is configured for multiple sensors. The Decrease/Power Button will turn on/off the display. The Enter button will scroll between the maximum, minimum and the current reading.
002	Hides the Output menu. All other setup menus are accessible.
003	Hides the analog options in the Output menu--only the relay options are accessible.
004	Hides the relay options in the Output menu--only the analog options are accessible.
005	All menus are hidden and all buttons are lock, except the Decrease/Power button, which will power on/off the MND.

*Also see "**Setting Mode Access Password"** under Sensor Label section of page 20.

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Menu Flow Chart

Main Menu

COMM → bAUd R
PARITY
STOPbT
C TYPE
SENAdR
NUMSEN
REGNUM
FUNCTN
REGTYP
SCANRT
WRITE
AdRCHG
EXIT

AL SET ← OUTPUT
AH SET
AL CAL
AH CAL
T1TYPE
T1REAd
T1 WIN
T2TYPE
T2REAd
T2 WIN
EXIT

AUTO ← AdVSET
dEC PL
MASK
SHIFT
MLTPLR
bAR 0
bAR 100
OVR-Ld
bAT EN
bATFUL
bATLOW
EXIT

SENLAb → SEN 1
SEN 2
SEN 3
SEN 4
SEN 5
SEN 6
SEN 7
SEN 8
SEN 9
SEN 10
LOERST
EXIT

DISPLAYED VALUE

54321
GALLON

Main Menu

MAXMIN ← ENTR
TEMP C
TEMP F
2 REAd
2Rd 1C
2Rd 1F

PCTFUL → SEN 1
SEN 2
SEN 3
SEN 4
SEN 5
SEN 6
SEN 7
SEN 8
SEN 9
SEN 10
LOERST
EXIT

CU FT ← UNITS
MCU FT
GALLON
CU M
LITERS
CU IN
bARREL
PCTFUL
CUSTOM

bLIGHT → MOdE
bRTNES
EXIT

EXIT

INPUT → SAM RT
AVERGE
EXIT

Main Menu

• UNITS (Units of Measure Label)

Allows the user to select the unit of measure label that will appear on the lower display line.

Options:

CU FT (Cubic Feet)	LITERS (Liters)
MCU FT (Million Cubic Feet)	CU IN (Cubic Inches)
GALLON (Gallons)	bARREL (Barrels)
CU M (Cubic Meters)	PCTFUL (Percent Full)
CUSTOM (Custom Units)	

NOTE: the units of measure selected will be applied to all sensor readings and cannot be set individually for each sensors.

NOTE: the units label will automatically display PCTFUL (percent full) for any reading being displayed in Percent Full mode (see page 21 for more information).

• ENTR (Enter Button Function)

Selects the function of the ENTER button when in standard operating mode.

Enter Button Function:

*2RD IF	cycles between 2 readings & temperature in ^{0}F.
*2RD IC	cycles between 2 readings & temperature in ^{0}C.
*2 REAd	cycles between 2 readings.
TEMP F	cycles between the reading and the temperature in ^{0}F.
TEMP C	cycles between the reading and the temperature in ^{0}C.
MAXMIN	cycles between the present reading and the highest and lowest readings.

*2nd reading is applicable to MP dual-float sensors only.

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• AdVSET (Advanced Settings)

AUTO (Auto Off): The Auto-Off feature will automatically power off the MND whenever no buttons are pressed within the specified time frame. The minimum Auto-Off time is 15 seconds. To disable the Auto-Off feature, set the value to 65535 (default).

> NOTE: the Auto-Off cannot be set to less than the relay "On Time" setting when using the Timed Relay option (see Outputs).

dEC PL (Decimal Place): defines where the decimal point will be displayed within the reading.

> NOTE: most APG sensors have the ability to set the number of decimal places of the readings being sent to the MND. Refer to the sensor manual for more information.

MASK (Digit Mask): allows the user to mask the value of the least significant digit(s), up to 3 places, so that masked digit(s) will always display 0 and will not increment.

SHIFT (Digit Shift): allows the user to shift the reading to the right by dividing the reading by 10, 100, or 1000.

MLTPLR (Multiplier): allows the user to apply a conversion multiplier to the sensor readings. For example, a multiplier setting of 2.0 will double the reading received from the sensor.

> NOTE: most APG sensors have the capability to apply a conversion multiplier to the reading before the value it is sent to the MND.

bAR 0 (Bar Graph 0%) & bAR 100 (Bar Graph 100%): define the readings associated with 0% and 100% on the display bar graph. Bars will appear/disappear in 10% increments of the total span.

> NOTE: the bar graph limits will be applied to all sensor readings when multiple sensor are being displayed, and cannot be set individually for each sensor.

(Advance Settings continued on next page)

OVR-Ld (Overload): allows the user to set an overload warning if the reading increases beyond the specified value.

> NOTE: when displaying the readings from multiple sensors, the Overload setting will be applied to the readings of all the sensors and cannot be set for each sensor individually. By default the Overload is set to 99999 so that the overload warning will only be displayed when a sensor reading is greater than 5-digit limit of the display.

bAT EN (Battery Enabled): allows the user to select either No Battery, Internal Battery or RST Battery options. The Internal Battery option is used to monitor the voltage of a battery powered MND.   The RST Battery option is used to monitor the supply voltage of an RST-5000 module acting as the master device.

> NOTE: the Internal battery indicator is limited to battery voltages less than 15 Vdc.

bATFUL (Battery Full Voltage): sets the voltage associated with a full battery indication.

bATLOW (Battery Low Voltage): sets the voltage associated with a low battery indication.

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• OUTPUT (Outputs)

The MND is offered with optional outputs, such as solid-state relays, or 4-20 mA or 0-5 Vdc analog signals. Not all output menu options are applicable to all MND configurations.

> NOTE: when displaying the readings from multiple sensors, the Sensor Address setting determines which sensor is controlling the output(s) of the MND.

AL SET (Analog Low Set-point): sets the reading associated with the low analog value (either 4mA or 0V).   Used for analog output or analog input.

AH SET (Analog High Set-point): sets the reading associated with the high analog value (either 20mA or 5V). Used for analog output or analog input.

AL CAL (Analog Low Calibration): adjusts the low end of the analog output (either 4mA or 0V). Increasing/decreasing the value will cause an increase/decrease at the low end of the analog output.

AH CAL (Analog High Calibration): adjusts the high end of the analog output (i.e. either 20mA or 5V). Increasing/decreasing the value will cause an increase/decrease at the high end of the analog output.

T1TYPE & T2TYPE (Trip 1&2 Type): determines the basic functional logic of the solid-state relay outputs as described in the Trip Type descriptions on pages 14-16.

> NOTE: the MND's <u>solid-state relays are rated for a maximum switched load of 120 mA.</u>

T1READ & T2READ (Trip 1&2 Reading): defines the display reading that corresponds to a change in the state of the associated relay output, as determined by the Trip Type selected.

T1 WIN & T2 WIN (Trip 1&2 Window): defines the secondary value (beginning from the Trip Reading) for Exclusive, Inclusive, and Hysteresis Near & Far Trip Types (refer to descriptions below). For example: if the Trip Reading is set to 250, and the secondary trip value is desired at a reading of 350, then the Trip Window should be set to 100. (250 + 100 = 350)

Trip Type Descriptions

Refer to the chart on the next page for an illustration of Near, Far, Exclusive, Inclusive and Hysteresis Near & Far trip types.

NEAR:

The output will activate whenever the reading is less than the Trip Reading setting (refer to chart on next page).

EXCLSV (Exclusive):

The output will activate whenever the reading is less than the Trip Reading OR greater than the Trip Reading + Trip Window (refer to chart on next page).

H NEAR (Hysteresis Near):

The output will activate until the reading is greater than the Trip Reading + Trip Window, at which point the output will deactivate and remain in that state until the reading is less than the Trip Reading (refer to chart on next page).

FAR:

The output will activate whenever the reading is greater than the Trip Reading (refer to chart on next page).

INCLSV (Inclusive):

The output will activate whenever the reading is greater than the Trip Reading and less than the Trip Reading + Trip Window (refer to chart on next page).

H FAR (Hysteresis Far):

The output will activate when the reading increases beyond the Trip Reading + Trip Window, and will remain active until the reading falls below the Trip Reading. The output will remain deactivated until the reading is once again greater than the Trip Reading + Trip Window (refer to chart on next page).
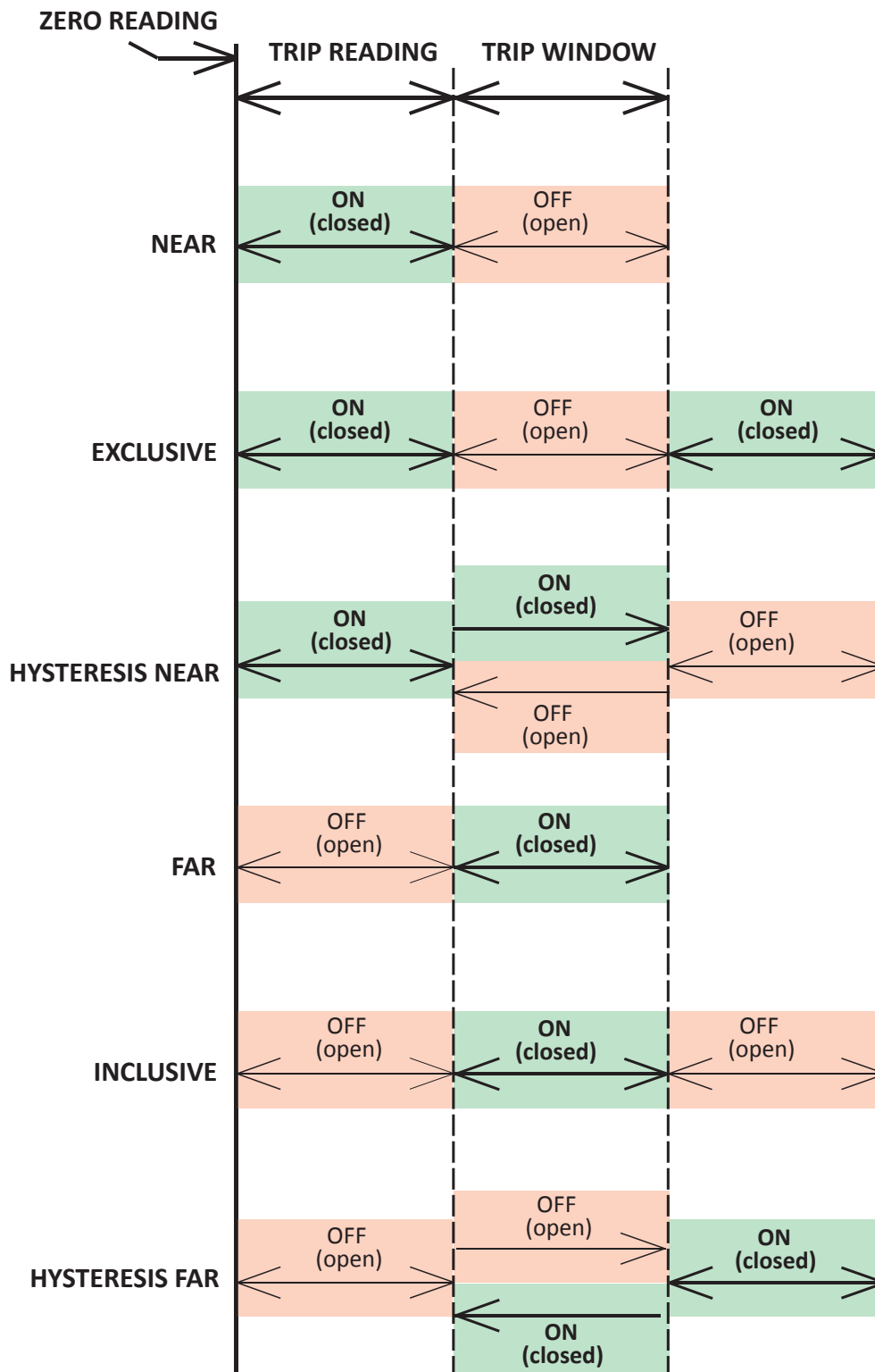
ON:

Holds the output closed whenever the display is powered.

OFF:

Disables the output.

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Trip Type Descriptions (continued)

ZERO READING

TRIP READING   **TRIP WINDOW**

NEAR

ON
(closed)

OFF
(open)

EXCLUSIVE

ON
(closed)

OFF
(open)

ON
(closed)

HYSTERESIS NEAR

ON
(closed)

ON
(closed)

OFF
(open)

OFF
(open)

FAR

OFF
(open)

ON
(closed)

INCLUSIVE

OFF
(open)

ON
(closed)

OFF
(open)

HYSTERESIS FAR

OFF
(open)

OFF
(open)

ON
(closed)

ON
(closed)

Trip Type Descriptions (continued)

<u>LOERST</u> (LOE/RST):
forces the output to follow the state of the corresponding output of an LOE or RST
sensor acting as the master device. For example, whenever output T1 of the LOE/RST
activates/deactivates, then output T1 of the MND will activate/deactivate as well.

<u>TIME R</u> (Timed Interval):
sets the output to activate on a timed interval. The Interval-Time (INTMIN) sets the
time between activations (in minutes), and the On-Time (ON SEC) determines how
long the output remains active at each interval (in seconds).

> NOTE: when using the Timed Interval in conjunction with the Auto-Off feature, the
> MND will wake (power on) at each Interval and will remain powered on for the
> duration of the relay On-Time regardless of the Auto-Off setting.
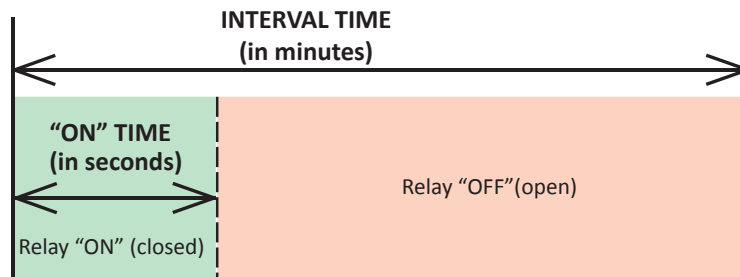
*<u>H TEMP</u> (Heater Temperature):
The LCD heater is controlled using Trip Relay 1. Set the heater "on" temperature
using the Trip 1 Reading (T1READ) parameter (in ^{0}C). The Trip 1 Window (T1 WIN)
parameter is used to set the "off" temperature, defined by the number of degrees above
the on temperature.

For Example: to activate the heater at -30 ^{0}C and deactivate the heater above -10 ^{0}C

        T1TYPE set to H TEMP
        T1READ set to -0030
        T1 WIN set to 00020

*Optional Feature

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Switched Power Source

This option is designed to allow an internal battery powered MND to share the battery power with one of APG's Modbus sensors (MNU, MP, or MPT series) to create a simple yet complete monitoring system. Whenever relay 1 (T1) is active, the battery voltage will be applied to the switched power source output (which should be connected to the voltage input of the sensor). By setting relay 1 to "On" and then setting up a short Auto-Off timer (refer to Advanced settings), the user can simply push the power button on the MND to wake the system and poll the sensor to get the reading. The Auto-Off will automatically power down the system to save battery life. APG recommends an Auto-Off setting of 15-20 second in order to maximize battery life.

WARNING! the switched power output sources voltage directly from the battery, and caution must be taken not to let the output come in contact with any of the other output lines (DC common or the communication lines).

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• COMM (Communications)

bAUd R (Baud Rate): 2400, 9600, 19200, 38400

PARITY: even, odd, none

STOPbT (Stop Bit): 1, 2

   NOTE: all APG Modbus based sensors communicate using 9600 baud, no parity and 1 stop bit.

C TYPE (Communications Type):

   MASTER: sets the MND to operate as the master device.

   SNIFER (Sniffer): sets the MND to passively monitor communications between a master device and one or more sensors. The master device must be actively polling the sensor(s) in order for the MND to update the reading(s).

   LRSNIF (LOE/RST Sniffer): functions the same as Sniffer mode with addition of monitoring the readings from an LOE series or RST-5000 series Ethernet based sensor (acting as the master device).

   SETUP: sets the MND to act operate as a "slave" device in order to be programmed using the APG Modbus software.

      NOTE: the Sensor Address parameter (see below) is used to set the MND's own sensor address when in operating in Setup mode.

   *AINPUT: displayed reading is based on the analog input signal and related settings (*Optional feature. Refer to **INPUT** menu section for more information).

SENAdR (Sensor Address): sets the address number of the sensor to be displayed when only one sensor is being monitored. The Sensor Address is also used to set the MND's own address when operating in Setup mode.

   NOTE: in order to monitor readings from multiple sensors, the assigned sensor address numbers must begin at 1 and increment sequentially. For example, if 5 sensors are to be monitored, the sensor addresses must be set to 1 thru 5.

   NOTE: when displaying the readings from multiple sensors, the Sensor Address setting determines which sensor is controlling the output(s) of the MND.

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NUMSEN (Number of Sensors): sets the number of sensors to be monitored. When using the MND to display readings from multiple sensors, the sensor addresses must begin at 1 and increment sequentially (see note above).

REGNUM (Register Number): sets the register number to be displayed. The readings of APG sensors are stored in register 30303.

> NOTE: the register number is entered using only the last 3 digits of the full register number. For example, register 30303 would be entered as 303, or register 40401 would be entered as 401.

FUNCTN (Function): sets the function code for the register to be displayed; 3 = holding resister, 4 = input register. Sensor readings are stored in input registers, while sensor parameter values are stored in holding registers.

REGTYP (Register Type): sets the bit type of the register to be displayed. Options are:

signed, 8 bit, low byte (S8L)	signed, 16 bit (S16)
signed, 8 bit, high byte (S8H)	unsigned, 16 bit (U16)
unsigned, 8 bit, low byte (U8L)	signed, 32 bit (S32)
unsigned, 8 bit, high byte (U8H)	unsigned, 32 bit (U32)

> NOTE: the readings of APG's sensors are stored as an unsigned 32-bit value. Refer to the sensor's user manual for a list of register numbers and their corresponding register types.

SCANRT (Scan Rate): determines how often the MND polls the sensor(s) (in seconds) when operating in Master mode.

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WRITE: allows the MND, operating in Master mode, to write a value to a specific holding register of a specific sensor. When Write is selected, the MND will guide you through the following steps:

Sensor Address: set the address number of the target sensor.
Register Number: set the register number you wish to change.
Register Type: set the type of register being written (16-bit or 32-bit).
Register Value: set the value you want to write to the selected register.
Write Yes/No: select Yes to write the new register value and complete the procedure, or No to cancel the write, and return to the Communications menu.

Write function example: changing the Empty Distance value (register 40407) to 2150 in sensor address number 5.

Sensor Address: 05
Register Number: 407
Register Type: U16 (unsigned 16-bit).
Register Value: 02150
Write Yes/No: select Yes by pressing Enter.

AdRCHG (Address Change): allows the user to quickly change a sensor's address when the MND is operating as the Master device. Simply enter the current address of sensor you wish to change (NOW), then enter the new address you wish to write to the sensor (NEW).

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• SENLAb (Sensor Labels)

Allows the user to assign a custom label for each sensor being displayed (up to 10 sensors + an LOE/RST master). The sensor label will appear on the lower display line, which will alternate between the Sensor Label and the selected Unit of measure.

> NOTE: <u>Setting a Mode Access Password</u> (refer to Access Modes on page 7). If a label is assigned for Sensor 10, the label becomes the password to access the Mode setting. If the label for sensor 10 is set to the default of 10AAAA, then no password will be required to access the Mode setting.

• PCTFUL (Percent Full)

Allows sensor readings to be displayed as a percentage of full based on a user defined 100% value.

To enable the Percent Full feature, select PCTFUL in the main menu. Select the sensor number you want to display as a percentage of full, and enter the value associated with 100%. 0% (empty) is assumed to be 0. Setting the value to 00000 (default) will disable the Percent Full feature.

> NOTE: the label PCTFUL will be automatically be displayed as the units of measure for all sensors running in Percent Full mode.

> NOTE: when controlling one of the MND's outputs with a sensor setup to display in Percent Full mode, the settings controlling the output need to be entered based on the underlying readings and not the displayed percentage value.

• *bLIGHT (Back Light) *Optional Feature

The Mode options include: On, Off, 30 Sec, 1 min, 2 min, 4 min, 8min and 16 min. To adjust the backlight intensity, select brightness (bRTNES) in the menu and use the up/down arrow buttons to increase/decrease the brightness.

- ***INPUT (Analog Input)** *Optional Feature

Used to adjust how the MND reads the analog input signal.

SAM RT: determines how often the MND reads the analog input signal.

AVERGE: determines how many readings of the analog signal will be averaged together to become the displayed reading. A higher average setting will result in smoother readings but will also cause slower response to rapid changes.

The following is a list of parameters required to read an analog input:

> COMM menu:
>   Set C-TYPE to AINPUT.
>
> OUTPUT menu:
>   Set AL SET to the value associated with a 4mA input signal.
>   Set AH SET to the value associated with a 20mA input signal.
>   *Adjust AL CAL and AH CAL as necessary.
>
> INPUT menu:
>   *Adjust SAM RT as necessary.
>   *Adjust AVERAGE as necessary.

> *parameters normally do not require adjustment.

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Programming the MND using APG Modbus Software

The MND's "Setup" communications type (see C-TYPE on page 17) allows the MND to be programmed using software instead of the buttons on the display. The software used to program the MND is the same software used to program any of APG's line of Modbus sensors (MNU, MP, PT series). Interfacing with the software also allows the user to save MND configurations to a PC, or to write a previously saved configuration back to the MND (see page 24).
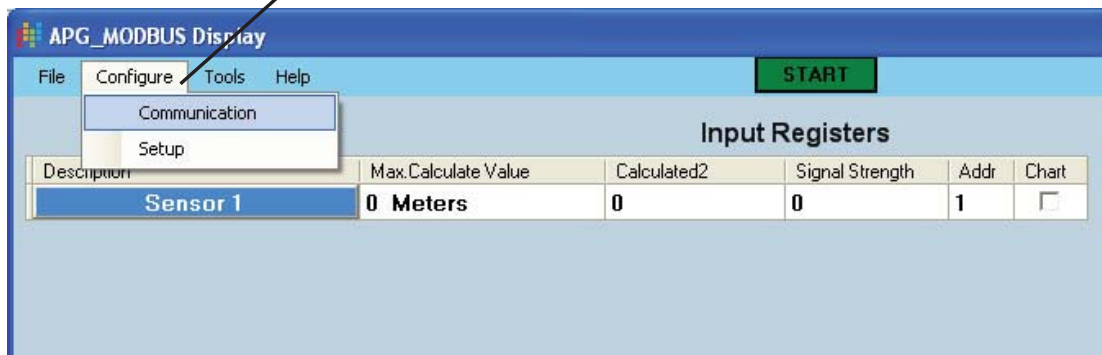
Use the following steps to establish communications and program the MND via the APG Modbus software:

Step 1: Use the buttons on the MND to enter the Communications menu and change the Communications Type (C-TYPE) to "SETUP".

Step 2: While still in the MND Communications menu, take note of the Sensor Address (SENAdR) setting. This setting will become the MND's address when communicating to the software.

Step 3: Install and run the APG Modbus software.

Step 4: Click on "Configure" in the top menu, then select "Communication" to bring up the Communication Configuration window.

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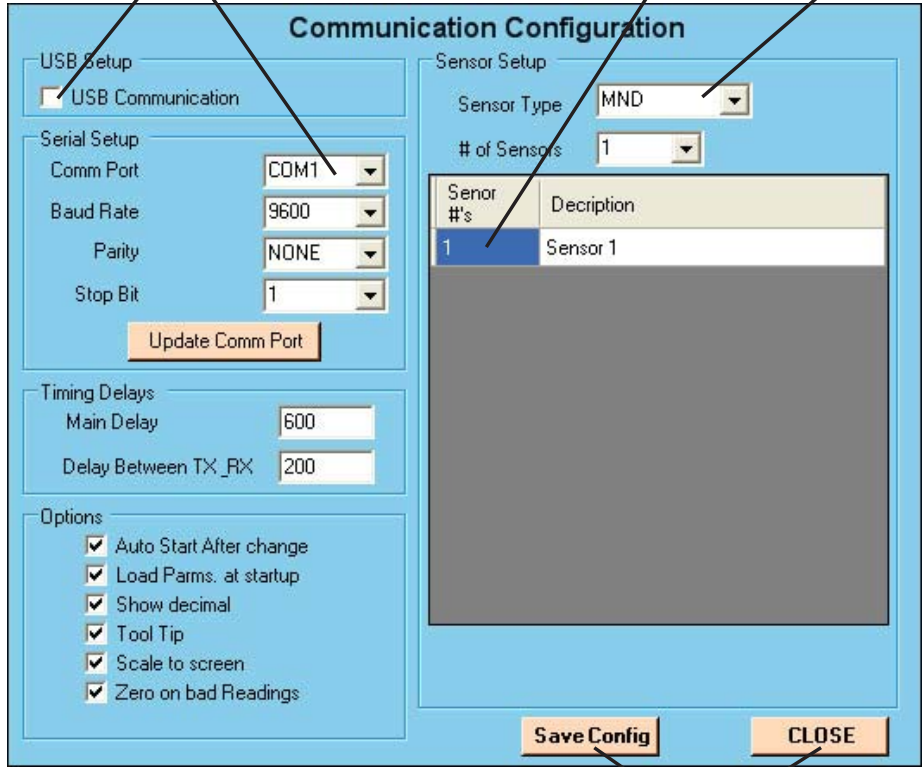Tel: 1/888/525-7300 • Fax: 1/435/753-7490 • www.apgsensors.com • sales@apgsensors.com

Step 5: Check the USB Communication box when using an RST-6001 RS-485 to USB converter.
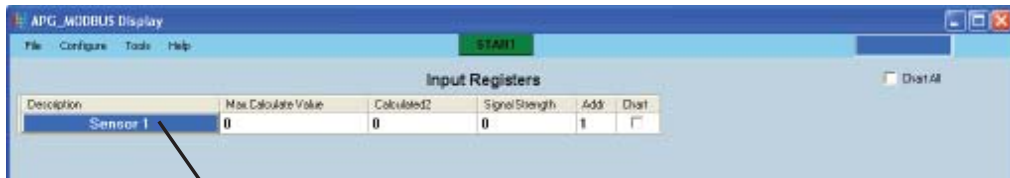
or

Select the Com Port assigned to the RS-485 to RS-232 converter being used.

Step 6: Ensure Sensor # matches the Sensor Address setting in the MND.

Step 7: Select MND

Communication Configuration

USB Setup
☐ USB Communication

Serial Setup
Comm Port — COM1
Baud Rate — 9600
Parity — NONE
Stop Bit — 1

Update Comm Port

Timing Delays
Main Delay — 600
Delay Between TX_RX — 200

Options
☑ Auto Start After change
☑ Load Parms. at startup
☑ Show decimal
☑ Tool Tip
☑ Scale to screen
☑ Zero on bad Readings

Sensor Setup
Sensor Type — MND
# of Sensors — 1

Sensor #'s	Decription
1	Sensor 1

Save Config   CLOSE

Step 8: Once all the changes have been made, click "Save Config" then click "Close"

APG_MODBUS Display
File Configure Tools Help   START

Input Registers   ☐ Chart All

Description	Max Calculate Value	Calculated2	Signal Strength	Addr	Chart
Sensor 1	0	0	0	1	☐

Step 9: Click on "Sensor 1 " to enter the programming window for the MND.

(continued on next page)

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Step 10: When the programming window opens, the register values should automatically populate (if not, click the "Receive All" button at the bottom of the window). To change a single parameter, simply click on the value you wish to change, enter the desired value, then click the adjacent "Send" button to write the new value to the MND.
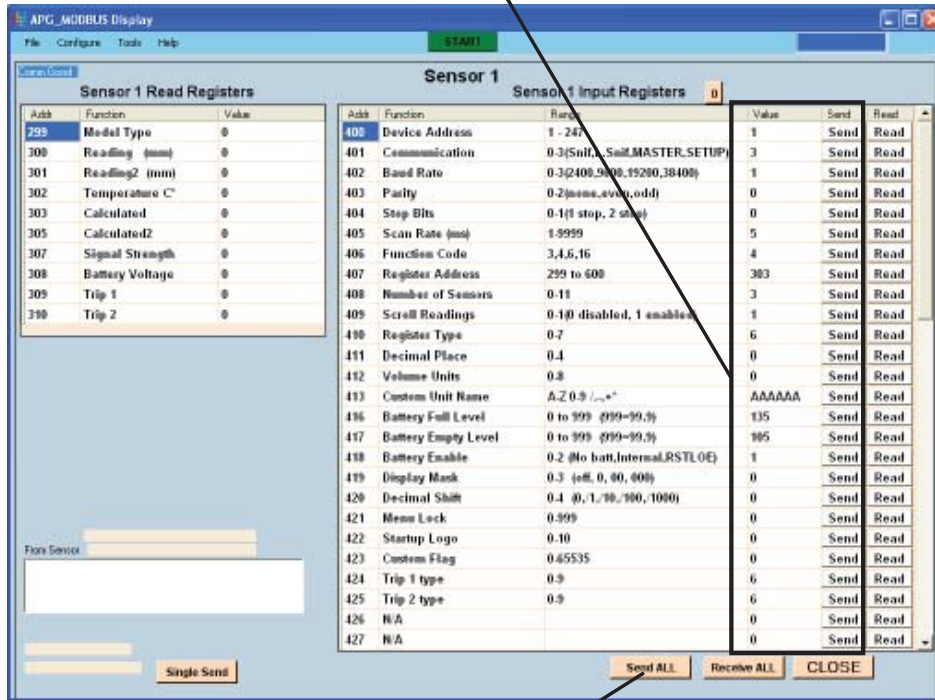
Step 11: To change multiple parameters, individually click on the values you wish to change, enter the desired values, then click the "Send All" button at the bottom of the window to write all the values to the MND.

After clicking "Send" or "Send All", a green window indicates good communication and the value was successfully written to the MND.

A yellow window indicates the value was not written due to either a communication failure or the value exceeds the allowable limits for that parameter.

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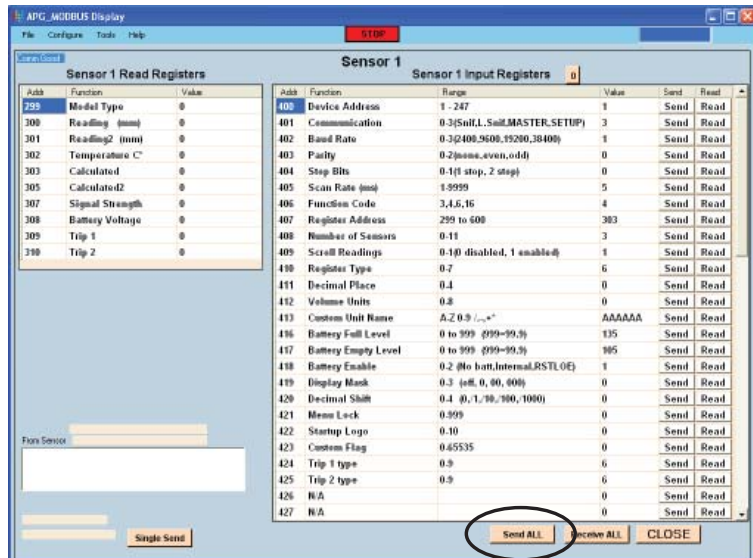
Saving a Settings Configuration

To save the current settings configuration, click on "File", then select "Save Mode Values". Choose the file name and location where you wish to save the file, then click "Save"
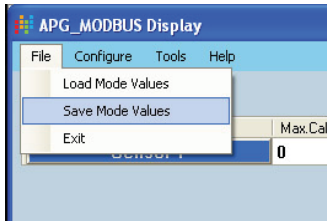
Recalling a Saved Settings Configuration

To upload a previously saved settings configuration to the MND, click on "File", then select "Load Mode Values". Choose a file you wish to upload, then click "Open". This will load the parameter values into the software. **Click the "Send All" button at the bottom of the window to write the parameters to the MND**.

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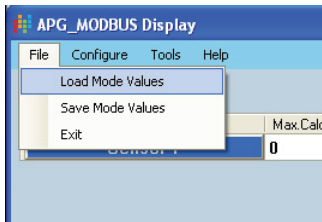
Communications Setup Examples

For APG sensors, the sensor readings are stored in register 303, which is an unsigned 32-bit register.

MND master displaying readings from a single sensor (address 1):

    C-Type = Master

    Number of Sensors = 1

    Sensor Address = 1

    Register Number = 303

    Function = 4

    Register Type = U32 (unsigned 32-bit)

MND master displaying multiple sensor readings (addresses 1-6):

    C-Type = Master

    Number of Sensors = 6

    Sensor Address = n/a (sensors addresses must begin at 1)

    Register Number = 303

    Function = 4

    Register Type = U32 (unsigned 32-bit)

MND in Sniffer mode displaying readings from a single sensor (address 3):

    C-Type = Sniffer

    Number of Sensors = 1

    Sensor Address = 3

    Register Number = 303

    Function = 4

    Register Type = U32 (unsigned 32-bit)

MND displaying the readings from 2 sensors + an LOE ultrasonic:

    C-Type = LOE/RST Sniffer (LRSNIF)

    Number of Sensors = 2 (the LOE sensor is assumed and not included in the count)

    Sensor Address = n/a (sensors addresses are assumed to begin at 1)

    Register Number = 303

    Function = 4

    Register Type = U32 (unsigned 32-bit)

Resetting the MND to factory defaults

Simultaneously press and hold the Decrease/Power button and Enter button for approximately 5 seconds. This will bring up the 3 digit operating mode number. Change the mode number to 125 and press the enter button. This will reset all parameter values to the following factory defaults:

Parameter	Value
Units	Gallons
Auto-Off	65535 (disabled)
Decimal Place	0
Digit Mask	Off
Digit Shift	0
Multiplier	1.000
Bar Graph 0	0
Bar Graph 100	10000
Over Load	99999 (max display value)
Battery Gauge Enable	No Battery
Battery Full	13.5 V
Battery Low	11.0 V
Analog Low Reading	0
Analog High Reading	99999
Analog Low Calibration	0
Analog High Calibration	16383
T1 Type	Off
T1 Reading	1000
T1 Window	500
T2 Type	Off
T2 Reading	1000
T2 Window	500
Baud Rate	9600
Parity	None
Stop Bits	1
C-Type	Master
Sensor Address	1
Number of Sensors	1
Register Number	303
Function	4
Register Type	U32 (unsigned 32-bit)
Scan Rate	000.5 seconds
Sensor Labels	Sen 1 - Sen 11
Percent Full	00000 (disabled)

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Specifications

Environmental:
   Housing: IP67
   Storage Temp: -40 to 160^{0}F (-40 to 71^{0}C)
   Operating Temp: 0 to 160^{0}F (-18 to 71^{0}C)

Electrical:
   Batteries: 9 V Lithium or 3.6 V Lithium (no outputs)
   External Power: 9-28 Vdc

Physical:
   Case Material: injection molded material EMI-X PDX-W-88341

4-20 mA Output:
   Input Voltage Requirements: 9 Vdc min (no load) to 28 Vdc max
   Signal Variance: +/-0.16 mA at set points
   Output/Input: 2-wire loop-powered
   Resolution: 14 bit
   Protection: reversed polarity

0-5 VDC Output:
   Input Voltage Requirements: 9 to 28 VDC
   Signal Variance: +/-0.05 VDC at set points
   Type: non-isolated 3-wire
   Resolution: 1 4 bit
   Protection: reversed polarity

Trip Point Solid State Relay Outputs:
   Maximum Switched Voltage: 120 V AC/DC
   Maximum Switched Current: 120 mA

MNU Series Ultrasonic

Input Registers (0x04):

Register	Type	Returned Data
30300	U16	Raw Distance/Level Reading (in mm)
30302	S16	Temperature Reading (in ^{0}C, signed)
30303-30304	U32	Calculated Reading (in selected units, no decimal)

Holding Registers (0x03):

Register	Type	Description	Value Range
40400	U16	Device Address	1 to 255
40401	U16	Units	1 to 3
40402	U16	Application Type	0-10
40403	U16	Volume Units	0 to 6
40404	U16	Decimal Place	0 to 3
40405	U16	Max Distance	0 to 10364 mm
40406	U16	Full Distance	0 to 10364 mm
40407	U16	Empty Distance	0 to 10364 mm
40408	U16	Sensitivity	0 to 100
40409	U16	Pulses	0 to 20
40410	U16	Blanking	0 to 10364 mm
40411	U16	Gain Control	0 to 4
40412	U16	Averaging	0 to 100
40413	U16	Filter Window	0 to 10364 mm
40414	U16	Out of Range Samples	0 to 255
40415	U16	Sample Rate	50 to 1000 msec.
40416	U16	Multiplier	1 to 1999
40417	S16	Offset	+/- 10364 mm
40418-40419		reserved	
40420	U16	Temperature Compensation	0 = off, 1 = on
40421-40435		reserved	
40436-40437	U32	Parameter 1 Data	0 to 100000 mm
40438-40439	U32	Parameter 2 Data	0 to 100000 mm
40440-40441	U32	Parameter 3 Data	0 to 100000 mm
40442-40443	U32	Parameter 4 Data	0 to 100000 mm
40444-40445	U32	Parameter 5 Data	0 to 100000 mm

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MP Series Magnetostrictive

Input Registers (0x04):

Register	Type	Returned Data
30300	U16	Raw Top Float Reading (in mm, unsigned)
30301	U16	Raw Bottom Float Reading (in mm, unsigned)
30302	S16	Temperature Reading (in ^{0}C, signed)
30303-30304	U32	Calculated Top Float Reading (in selected Units)
30305-30306	U32	Calculated Bottom Float Reading (in selected Units)

Holding Registers (0x03):

Register	Type	Description	Value Range
40400	U16	Device Address	1 to 255
40401	U16	Units	1 to 3
40402	U16	Application Type	0-10
40403	U16	Volume Units	0 to 6
40404	U16	Decimal Place	0 to 3
40405	U16	Max Distance	0 to 10364 mm
40406	U16	Full Distance	0 to 10364 mm
40407	U16	Empty Distance	0 to 10364 mm
40408	U16	Sensitivity	0 to 100
40409	U16	Pulses	0 to 20
40410	U16	Blanking	0 to 10364 mm
40411		reserved	
40412	U16	Averaging	0 to 100
40413	U16	Filter Window	0 to 10364 mm
40414	U16	Out of Range Samples	0 to 255
40415	U16	Sample Rate	50 to 1000 msec.
40416	U16	Multiplier	1 to 1999
40417	S16	Offset	+/- 10364 mm
40418-40420		reserved	
40421	S16	RTD Offset (0C)	-100 to 100
40422	U16	Float Window	0 to 1000 mm
40423	U32	Top Float Offset	+/- 10364 mm
40424	U32	Bottom Float Offset	+/- 10364 mm
40425	U32	Gain Offset	0 to 255
40426-40435		reserved	
40436-40437	U32	Parameter 1 Data	0 to 100000 mm
40438-40439	U32	Parameter 2 Data	0 to 100000 mm
40440-40441	U32	Parameter 3 Data	0 to 100000 mm
40442-40443	U32	Parameter 4 Data	0 to 100000 mm
40444-40445	U32	Parameter 5 Data	0 to 100000 mm

Notes

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