

MAX Position Advanced
 Position Indicator with
 Presets and Outputs



“MAX Position Advanced” is a programmable position indicator and preset counter with a Reference input and set point, four position presets and eight complimentary outputs. Go through zero counting, plus / minus operation, non-volatile counter and ‘on-the-fly’ programming features satisfy many process applications. A six decade calibrator is provided for increased display resolution.

FEATURES

- Bidirectional (go thru zero) counter
- Non-Volatile counter operation.
- Four user programmable preset setpoints
- Programmable reference setpoint
- Programmable Operation; A-B, A+B, Quad
- Programmable 6 decade correction constant
- Selectable Input logic; x1, x2 and x4
- STOP/HOLD, REFERENCE ENABLE, OUTPUT DISABLE and REFERENCE Control inputs
- 4 Wire / 2 Wire RS-485 Provides LOCAL and REMOTE process Control Capability Modbus RTU protocol
- FRAM Memory for Setpoint storage
- Built In Self- Diagnostics
- Eight Alpha Numeric, 14 Segments LED display

KEY SPECIFICATIONS

- Bipolar Six Decade Counter (+/-999999)
- Six Decade Input Calibrator
- DC to 40kHz Count Rate
- DC to 20kHz Quadrature Input Rate
- Programmable Input Logic (x1,x2, or x4)
- Four Programmable Bipolar Preset Limits
- Eight Solid State Preset Outputs
- Counter Presetting with Reference Input
- +12VDC @ 175mA Transducer Supply
- 85-265 VAC Operation (12VDC Optional)

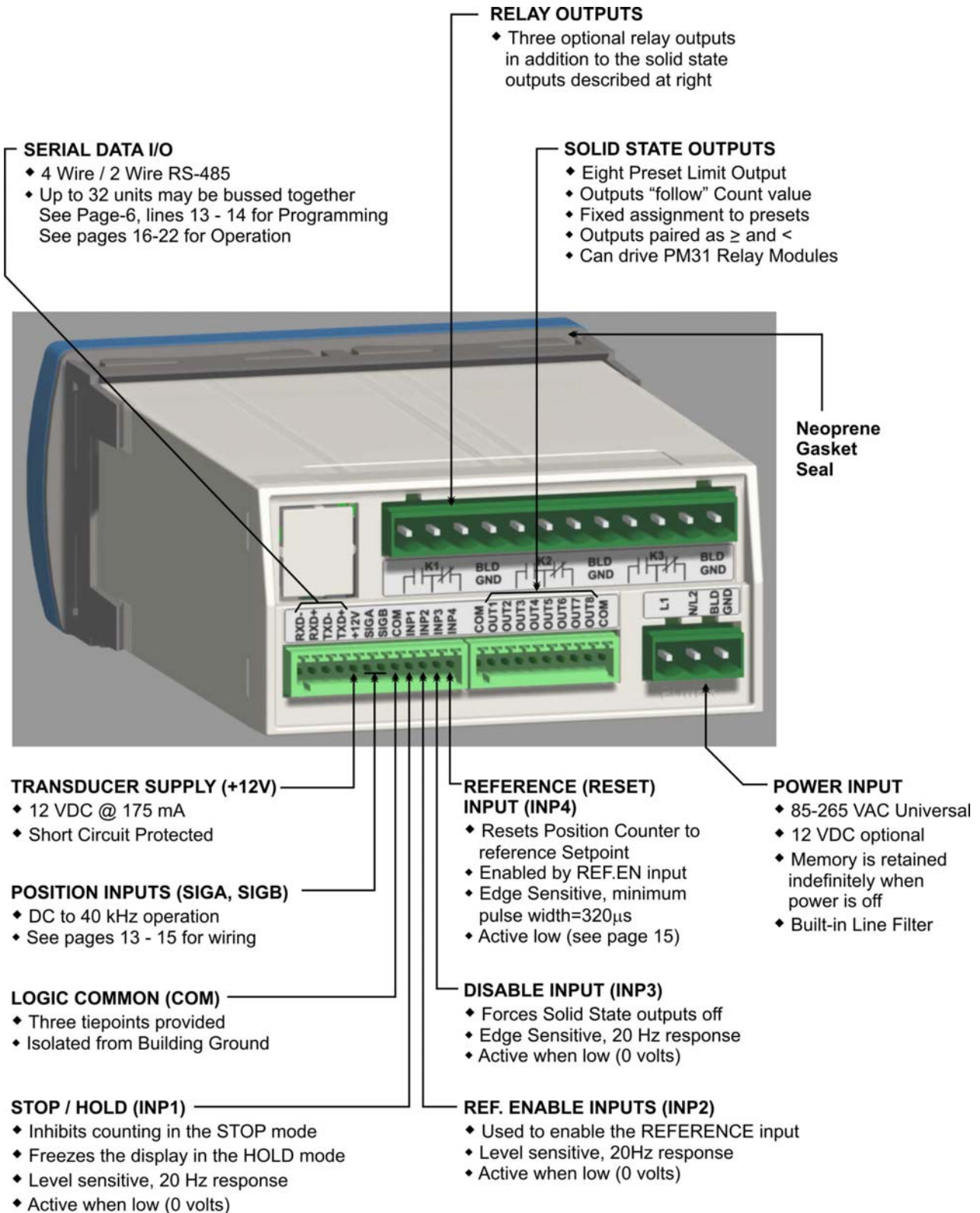
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Eagle Signal





Input Power: 85-265 VAC, 50-60Hz, 20 VA
12 VDC @ 0.5A. Optional

Accessory Supply: 12 VDC @ 175 mA.

Position Counter:
 Range: +/- 6 Decades
 Presets: 4 Individual; A, B, C, D
 Operation: Non-volatile unidirectional or Bidirectional with following modes A-B, A+B, Quadrature
 Count Rate: 40 kHz x1, 20 kHz x2, 10 kHz x4
 Outputs: Fixed assignment Solid state outputs for >= and < comparisons

Calibrator:
 Range: 6 Decade, 0.00001 to 9.99999

Position Inputs:
 Input Frequency: 40 kHz x1, 20 kHz x2, 10 kHz x4
 Input Type: Single ended, Current Source
 Input Logic: Programmable x1, x2 and x4
 Input High Level: 3.25 VDC min.
 Input Low Level: 1.75 VDC max.
 Input Impedance: 1.0 kΩ to common
 Input current: 3.25mA. steady state
 Input Response: 10µs. min high and low time

Control Inputs:
 Input Frequency: DC to 20Hz typ (320µs pulse width for reference input)
 Input Type: Single ended, current sinking
 Input Logic: Both edge & level sensitive as defined by Input use.
 Input High Level: 10VDC min. to 20 VDC max.
 Input Low Level: 0 VDC min. to 2 VDC max.
 Input Impedance: 4.7 kΩ pullup to +12 VDC
 Input Current: 2.5 mA. Steady state
 Input Response: 25ms. make and break time (310µs pulse width for reference input)

Display:
 Decades: Eight Alpha Numeric, 0.4" red LED
 Annunciators: Three Annunciators RUN, SET, PGM
 Decimal Point: User programmable
 Range: xx.xxxx to xxxxxx

Keyboard: Sealed tactile feel, 6 positions

Program Security: Program LOCK for lines 1-22

Control Outputs:
 Type: 8 Solid State Outputs, 100mA sink max., 24 VDC max.
 Logic: Output 'FOLLOW' counter value.
 Assignment: Outputs have fixed assignments.
 OUT 1 Position ≥ 'A' preset
 OUT 2 Position < 'A' preset.
 OUT 3 Position ≥ 'B' preset
 OUT 4 Position < 'B' preset.
 OUT 5 Position ≥ 'C' preset
 OUT 6 Position < 'C' preset.
 OUT 7 Position ≥ 'D' preset
 OUT 8 Position < 'D' preset.
 Where '≥' Means greater than or equal and '<' means Less than

Serial Interface:
 Type: RS-485 compatible (4 or 2 wire options with modbus protocol)
 Baud Rate: Selectable; OFF, 1200, 2400, 4800 or 9600
 Data: Binary
 Format: 1 START Bit, 8 Data Bit, 1 STOP Bit
 Protocol: ModBus RTU
 I.D. Number: Programmable 01 to 32: Allows multidrop systems.

Diagnostics:
 Test 0: Keyboard Test
 Test 1: FRAM Test
 Test 2: Input Test
 Test 3: Output Test
 Test 4: Display Test
 Test 5: Flash Memory Test
 Test 6: Date Code Test
 Test 7: Serial I/O Test
 Test 8: Return to Factory Programming

Mechanical:
 Enclosure: Plastic Moulded
 2.0" High x 4.0 Wide x 5.56" Deep
 Cutout: 1.77"[45mm] x 3.62" [92mm]
 Panel Thickness: 1/16" to 1/4"
 Panel Depth: 5.68" Minimum
 Weight: 0.68 lb [308 gm]

Environmental:
 Operating Temp: -15°C to +65°C
 Storage Temp: -30°C to +85°C
 Ambient Humidity: 90% and noncondensing

Controller Error Codes
 1. Low AC Line voltage (Displays LOW AC)
 2. Input Frequency Too fast (Displays FREQ MAX)



FRAM Error Codes
 1. Run Mode parameters corrupted (FRUNFAIL).
 2. Program Mode parameters corrupted (FPGMFAIL).

Note: Power cycle to clear the FRAM error

ANNUNCIATORS

- ◆ RUN constantly illuminated in the RUN mode
- ◆ SET constantly illuminated in the SETUP mode
- ◆ PGM constantly illuminated in the PROGRAM mode



DOWN KEY

- ◆ Sequences down through menu options of RUN or SETUP menu
- ◆ Sequences down through menu options of programming menu in the PROGRAM mode
- ◆ Decrement the number in edit mode (Highlighted digit)

UP KEY

- ◆ Sequences Up through menu options of RUN or SETUP menu
- ◆ Sequences Up through menu options of programming menu
- ◆ Increment the number in edit mode (Highlighted digit)

RIGHT KEY

- ◆ Sequences to the right in individual Programming menus or enters edit mode by highlighting the left most digit and sequences highlighting to the right digit in Program mode & in SETUP mode

RESET / CLEAR

- ◆ Presets position counter to reference setpoint in the RUN mode if enabled (ON)
- ◆ Clears display in the SETUP and PROGRAM modes

RUN/PGM

- ◆ Used to switch between the RUN and PROGRAM modes. Acts as an alternate action switch.

KEY

- ◆ Used to enter SETUP mode from the RUN mode.
- ◆ Press again to exit SETUP & go to RUN mode.
- ◆ Allows the unit to be programmed "on the fly". Used to direct address lines 1-22 while in PROGRAM mode, press KEY, line number, Key

RUN MODE:

FUNCTION	DESCRIPTION
POSITION	Currently measured process position in engineering units

SETUP MODE:

SETUP MODE (Entered by pressing KEY key)

REFERENCE	Reference setpoint in engineering units. Used to preset position counter
PRESET A	Preset Setpoint A in engineering units.
PRESET B	Preset Setpoint B in engineering units.
PRESET C	Preset Setpoint C in engineering units
PRESET D	Preset Setpoint D in engineering units

PROGRAM MODE

LINE	FUNCTION	DESCRIPTION
1	REFERENCE	Reference setpoint in engineering units.
2	PRESET A	Preset Setpoint A in engineering units.
3	PRESET B	Preset Setpoint B in engineering units.
4	PRESET C	Preset Setpoint C in engineering units
5	PRESET D	Preset Setpoint D in engineering units
6	INPUT CALIBRATOR	Calibration constant used to convert input counts into engineering units.
7	DECIMAL POINT	Display decimal point position for Position, Reference and Presets
8	OPERATION	Count operation selection; A-B(add/subtract), A+b (add/add), or Quadrature.
9	LOGIC	Input Logic selection; x1, x2 and x4
10	FRONT PANEL RESET	Select ON to enable front panel referencing; select OFF to disalbe
11	STOP / HOLD SELECT	Select STOP count or display HOLD function.
12	BAUD RATE	Serial baud rate. Selectable OFF, 1200, 2400, 4800 or 9600 baud.
13	ID NUMBER	Serial ID number. Programs unit serial ID (01-32).

RUN MODE

P 0

▶ ▲ ▼ No Function

RST CLR Reset to reference if FPRST is ON

KEY To enter Setup mode, Annunciator SET glows

RUN PGM LOC 2666 KEY To enter PROGRAM mode

SETUP MODE

Leaving SETUP mode returns to display Position

▼ R. 000000
 A. 000000
 B. 000000
 C. 000000
 ▲ D. 000000

KEY

▶ To edit parameters (The selected digit is highlighted)

RST CLR No Function

RUN PGM No Function

▲ ▼ For Menu navigation

▲ and ▼ To select a digit

▶ To sequence to next digit

KEY To save the value

RST CLR Clears the display(Reset to Zero)

Press

KEY To return to RUN mode lines

PROGRAM MODE

▼ 1 R. 000000
 2 A. 000000
 3 B. 000000
 4 C. 000000
 5 D. 000000

RST CLR No Function

RUN PGM Return to RUN mode

▶ To edit parameters (The selected digit is highlighted)

▲ ▼ For Menu navigation

▲ and ▼ To select a digit

▶ To sequence to next digit

KEY To save the value and come out from edit mode

RST CLR Clears the display(Reset to Zero)

KEY Asks for a line number (LINE 0) (enables to enter a line number, then press KEY to jump to the desired location)

6 CC. 100000

7 DP. OFF ▶ DP. .0 ▶ DP. .00 ▶ DP. .000 ▶ DP. .0000

8 OP. A-B ▶ OP. A+B ▶ OP. QUAD

9 LOGIC 1 ▶ LOGIC 2 ▶ LOGIC 4

10 FPRST.OFF ▶ FPRST. ON

11 STOP. CC ▶ HOLD. CC

12 BD. OFF ▶ BD. 1200 ▶ BD. 2400 ▶ BD. 4800 ▶ BD. 9600

13 ID. 32 Enter two digit serial address (01-32)

RUN PGM

The **MAX** Position Advanced controller provides a group of diagnostics to self test the controller and field wiring as well as helps the user diagnose machinery malfunctions. Nine diagnostic tests are provided and may be run only while the unit is in the PROGRAM mode. These tests should be done “offline”(user’s process not being controlled). The tests are outlined below along with the keyboard commands to control them.

LINE	DIAGNOSTIC	DESCRIPTION
14	TEST 0	Keyboard Test: Display echoes on each key press.
15	TEST 1	FRAM Memory Test; read / write operations of FRAM
16	TEST 2	Input Tests: Test for “Closures” on Inputs.
17	TEST 3	Output Test: Press ▲key and ▼key to select the number and press ► key to turn Solid state output ON. Press CLR to Turn ‘OFF’.
18	TEST 4	Display Test: Illuminates all segments.
19	TEST 5	PROM Memory test: Checksum comparison for program memory.
20	TEST 6	Date code Test: Displays date code version of firmware.
21	TEST 7	Serial Test: Provides loop-back test of the serial transmitter and receiver (will indicate ‘FAIL’ if the loop back connectors are not made).
22	TEST 8	Returns controller to the factory programmed state.

Test T0: Display shows: **T0. RDY**
 Press RIGHT key (in line 14)
 Then it will display **T0 RUN**
 The display with corresponding key press will be as shown below:

Key	Display
▲	UP KEY
▼	DOWN KEY
►	RIGHT KEY
KEY	Exits from the menu shows T0 RDY
RST/CLR	RESET KEY
RUN/PGM	RUN KEY

Test T1: Display shows: **T1. RDY**
 Press RIGHT key (in line 15)
 Then it will display **PASS/FAIL** indicating the FRAM test. Pass will be displayed if FRAM is ok. If Fail displayed means there is a problem with FRAM call Eagle Signal.
 Press **KEY** key to exit from the menu and the display show **T1. RDY**

Test T2: Display shows: **T2. RDY**
 Press RIGHT key (in line 16)
 Then it will display **IN** and the inputs connected to it(A and B) and it will display the following for the control inputs when externally pulled low.

Control input	Display
STOP/HOLD	1
Reference Enable	2
Disable Input	3
Ref. (Reset) Input	4

Press **KEY** key to exit from the menu and the display show **T2. RDY**

- Test T3:** Display shows: **T3. RDY**
Press RIGHT key (in line 17)
Then the display shows **OUTTST 1** and by scrolling up and down **OUTTST 2, OUTTST 3, OUTTST 4, OUTTST 5, OUTTST 6, OUTTST 7, OUTTST 8** are displayed, press RIGHT key to turn the corresponding Solid State / Relay output ON.
Press **RST/CLR** to make Solid State / Relay output OFF
Press **KEY** key to exit from the menu and the display show **T3. RDY**
- Test T4:** Display shows: **T4. RDY**
Press RIGHT key (in line 18)
Then all the LED's and annunciators glows indicating that the test is passed.
Press **KEY** key to exit from the menu and the display show **T4. RDY**
- Test T5:** Display shows: **T5. RDY**
Press RIGHT key (in line 19)
Shows FAIL/PASS indicating Flash test whether it is failed or passed.
Press **KEY** key to exit from the menu and the display show **T5. RDY**
- Test T6:** Display shows: **T6. RDY**
Press RIGHT key (in line 20)
It displays the version of the current module. (**VER 1**)
Press **KEY** key to exit from the menu and the display show **T6. RDY**
- Test T7:** Display shows: **T7. RDY**
Press RIGHT key (in line 21)
Shows FAIL/PASS indicating Serial communication is OK (if RXD+ shorted to TXD+ and RXD- shorted to TXD-) or not.
Displays **PASS** if serial communication is OK
Displays **FAIL** if serial communication is not OK.
Press **KEY** key to exit from the menu and the display show **T7. RDY**
- Test T8:** Display shows: **T8. RDY**
Press RIGHT key (in line 22)
Display shows **T8 RUN**. It loads all the factory programmed values.
Press **KEY** key to exit from the menu and the display show **T8. RDY**

EDITING PARAMETERS:

Enter the program mode by following the Note mentioned below. Reach a particular line which is required to change by pressing Down key, then press Right Key, the first digit highlights, which indicate edit mode. Edit value by using UP and DOWN keys, then press Right key which will highlight the next digit. After entering the value, to confirm or exit from edit mode, press **KEY** key.

NOTE 1:

To enter program mode from run mode, Press **RUN/PGM** key, Then the display shows **LOC 0000**, with the first digit highlighted. Then edit the value by using UP and DOWN keys for the first digit as **2**, then press RIGHT key which will take the highlighting to second digit. Enter value as **6**, similarly enter 3rd and 4th digits as **6**. After entering the value for **LOC as 2666**, Press **KEY** key, it will enter to program mode.

If the LOC doesn't match with 2666 then it will return to **RUN** Mode.

BASIC OPERATION:

The **MAX Position Advanced** operates as Unidirectional or Bidirectional counter with 'go thru zero' counting format. The **MAX Position Advanced** indicates both positive and negative numbers making it particularly useful in the display of four quadrant machine processes. A typical application is with a quadrature bidirectional transducer. The controller interprets direction and count. Four presets allow the user to program process limits and receive solid-state outputs signaling process status at a given position. Eight outputs are provided for user interface. Both 'greater than or equal' and 'less than' comparisons are provided for the four presets.

The value of the position counter is non-volatile, it is saved during programming and when power is removed from the unit. The Position counter contents are restored when exiting the Program mode and power is reapplied to the unit. The position counter can be preset to a Reference number by a 320 micro sec. pulse applied to the REF input if the REF.EN is active(input low). The position counter can be reset to zero by programming a reference setpoint of zero. The DISABLE input forces the outputs 'off' when active(low).

SETUP MODE OPERATION:

The Reference and limit presets may be dynamically changed while in the RUN mode of operation by entering the SETUP mode. The counter continues counting without loss if the operator is using the SETUP mode to change a preset. The SETUP mode is entered by pressing KEY. The SET annunciator glows. The control continues to operate, keeping track of position and comparing presets. While in the SETUP mode the CLR/RST, Right key and Up and Down keys are active allowing data to be changed as required.

If a REF input is received while in the SETUP mode it is ignored. This feature is required so that spurious outputs are not generated. You may change any or all the SETUP mode lines. Changes to the operational presets (those used in the RUN mode) are made upon exiting SETUP mode.

Any changes that are made in the SETUP mode are saved at the appropriate program lines when the SETUP mode is exited. Exit the SETUP mode by pressing KEY. Exiting the SETUP restored the display to the current position.

INPUT LOGIC and CORRECTION CONSTANT PROGRAMMING:

The input logic is user selectable for x1, x2 or x4 operation. This allows the user to effectively increase the resolution of the count input transducer. There are some limitations on the use of the input multiplier and they are outlined in the table below. In general, you cannot use x4 logic with a Unidirectional input device or x1 with a bidirectional device. (x2 logic detects the leading and trailing edges of each pulse, x4 logic detects leading and trailing edges of both signals on Quadrature inputs).

Count Mode	Input Logic	Unidir	Bidir	Note
A-B, A+B	x1, x2	OK	--	1
Quad	x2, x4	--	OK	2

Notes:

- 1) Default is x1 logic if x4 is selected
- 2) Default is x2 logic if x1 was selected.

The correction constant has a user programmable range of six decades. This feature allows the user to factor the incoming count into useful engineering units (inches, cm, mm, etc.). The resolution of the count transducer and input logic should be chosen to take advantage of the best instantaneous accuracy of the calibrator. The best instantaneous accuracy is obtained with the correction constant setting not exceeding 1.00000. The general form of the equation for the correction constant is given below along with a typical example.

$$\begin{array}{l} \text{x1 Logic} \\ \text{(40kHz max)} \end{array} \quad \text{CC} = \frac{\text{Displayed value in engineering units}}{(\text{Display resolution}) \times (\text{input Pulses}) \times 1}$$

$$\begin{array}{l} \text{x2 Logic} \\ \text{(20kHz max)} \end{array} \quad \text{CC} = \frac{\text{Displayed value in engineering units}}{(\text{Display resolution}) \times (\text{input Pulses}) \times 2}$$

$$\begin{array}{l} \text{X4 Logic} \\ \text{(10kHz max)} \end{array} \quad \text{CC} = \frac{\text{Displayed value in engineering units}}{(\text{Display resolution}) \times (\text{input Pulses}) \times 4}$$

Use the necessary x1, x2 or x4 logic to make the correction constant (CC) as close to 1.00000 as possible without exceeding the maximum input frequency for that selection.

EXAMPLE 1:

A 1000 PPR Rotopulser is coupled to a machine with 1.2375 inches of travel per revolution of the Rotopulser. Display resolution is 0.001 with x2 logic selected.

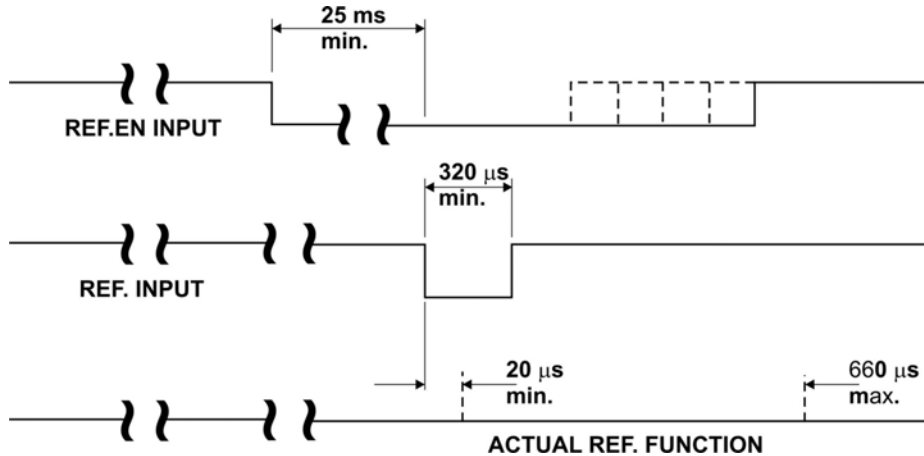
$$\text{CC} = \frac{1.2375}{(0.001)(1000) \times 2} = 0.61875$$

EXAMPLE 2:

If the Correction Constant for an application can be made to be exactly 0.50000 with the formulas, the display resolution can be improved to 0.0005 inches by setting the correction constant to 5.0000 and moving the display decimal point to the left 1 digit.

REFERENCE (REF) AND REFERENCE ENABLE(REF. EN.) INPUT TIMING:

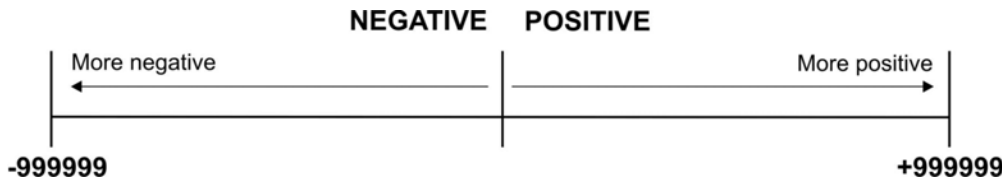
Refer to the timing diagram below for REFERENCE input timing. The REF. EN input must be active (low) to enable the reference logic. The REFERENCE input is a negative going pulse (current sinking) with a duration of 320 micro seconds min. Re-referencing will not occur until the pulse goes inactive for a minimum of 320 micro sec. at which time the logic is re-enabled.



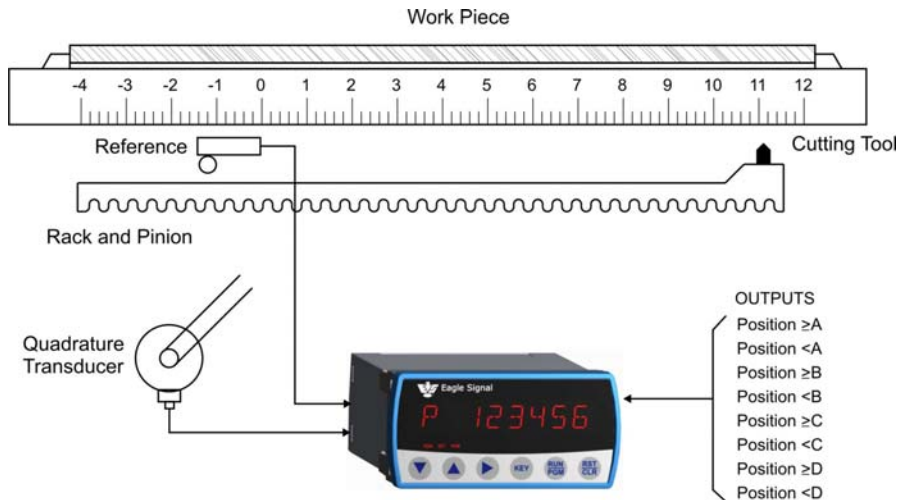
PRESET OUTPUT COMPARISONS:

The preset outputs are generated based upon standard mathematical conventions. This is shown graphically by the number line below. In the positive quadrants the absolute values of the presets determine the comparison with the position counter. However, in the negative quadrants, the sign must be taken into account. Position and presets are always referenced to ZERO.

EXAMPLE : Position Counter: -100.000
 Preset A -90.000 Position is less than Preset A
 Preset B -110.000 Position is greater than Preset B

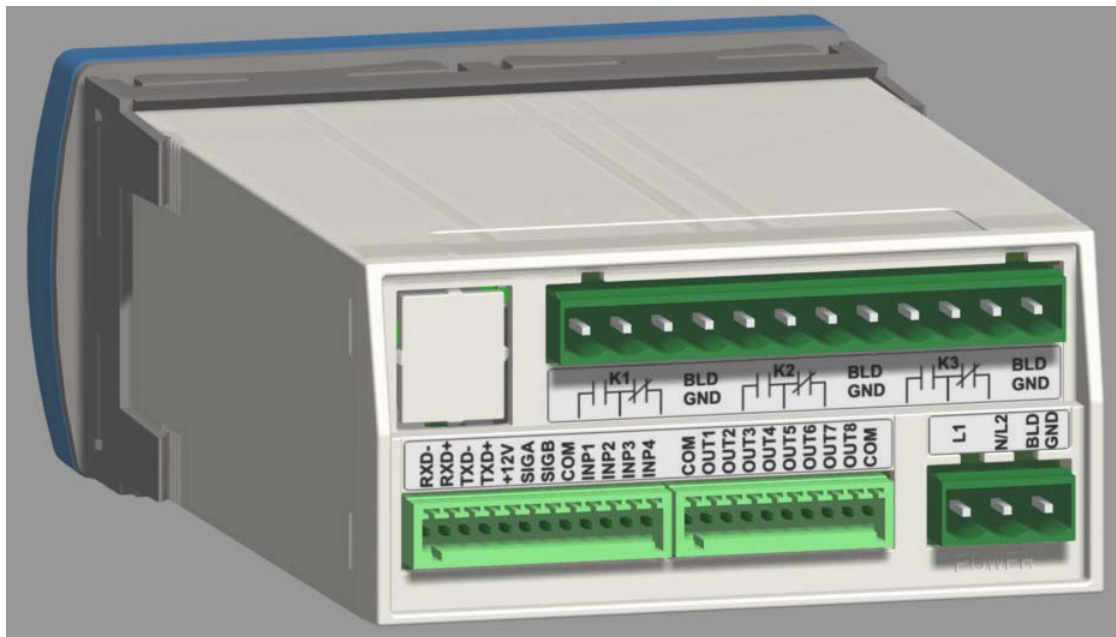


TYPICAL APPLICATION



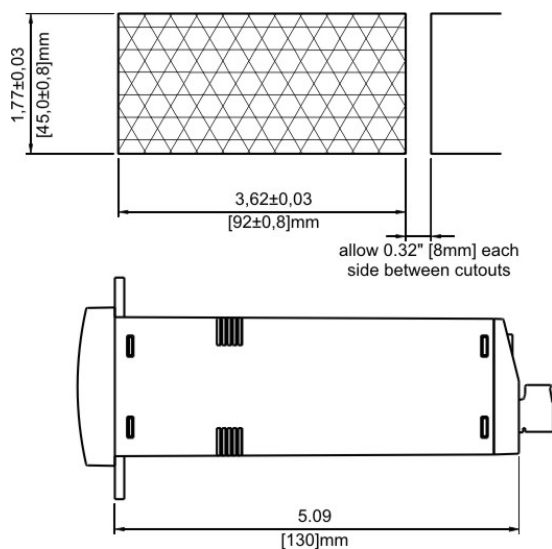
NOTES:

1. Installations must be made in accordance with EAGLE SIGNAL manual 845 - 130.
2. For application which require multiple products operation in parallel, see 845 - 130.
3. When replacing older products, consult 845 - 130 for information regarding circuitry changes.



A. PANEL MOUNTING:

Make Panel Cutout. Affix adhesive gasket (if required) to panel. Remove the Unit holder and slide unit through the cutout. Slide back the Unit holder.



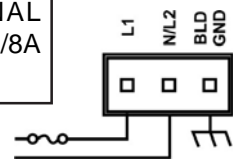
B. INPUT POWER

AC POWER

Connect AC power to the unit Connect terminal **BLD GND** to BUILDING GROUND!

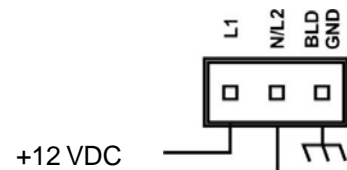
UNIT REQUIRES EXTERNAL FUSE. USE 1/4A. FOR 115V (1/8A FOR 230V) FAST-BLOW

85-265 VAC, 50 / 60Hz, 20 VA



DC POWER

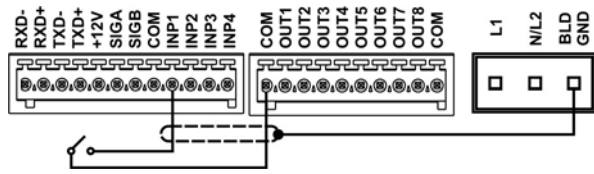
Connect +12 VDC to terminal **L1** and 12 Volt ground to terminal **N/L2**. Connect terminal **BLD GND** to BUILDING GROUND!



C. CONTROL INPUTS

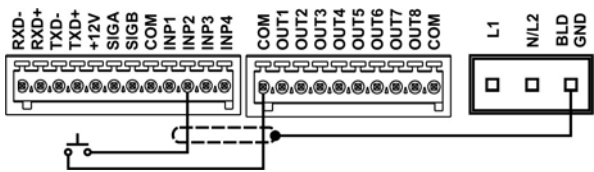
STOP/HOLD (Term INP1)

Level sensitive 20 Hz Response 4.7 kΩ to + 12 VDC (Shows '1' during input diagnostic test).



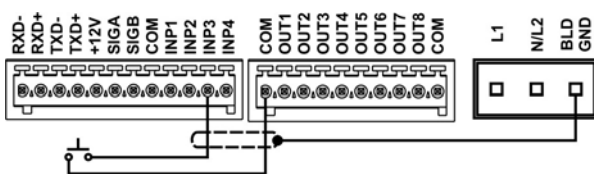
REFERENCE ENABLE (Term INP2)

Edge sensitive 20 Hz Response 4.7 kΩ to + 12 VDC (Shows '2' during input diagnostic test).



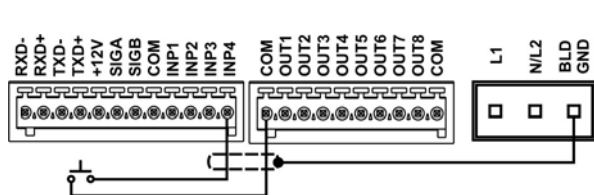
OUTPUT DISABLE (Term INP3)

Edge sensitive 20 Hz Response 4.7 kΩ to + 12 VDC (Shows '3' during input diagnostic test).

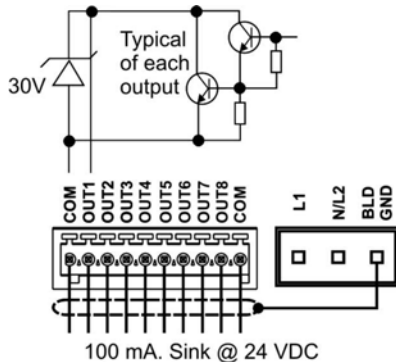


REFERENCE (RESET) (Term INP4)

Edge Sensitive 20 Hz Response 4.7 kΩ to + 12 VDC (Shows '4' during input diagnostic test).



D. CONTROL OUTPUTS

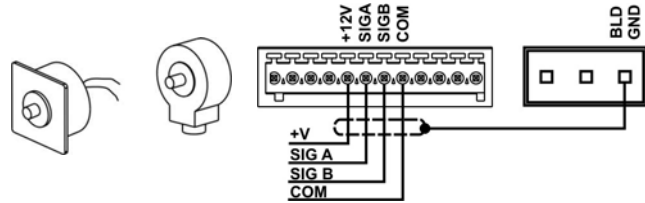


E. COUNTER INPUTS

BIDIRECTIONAL ENCODERS

(Type 42, 62 Rotopulser)

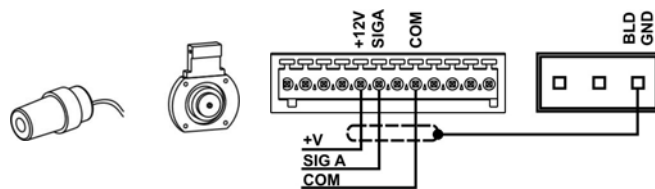
SIG A leads SIG B by 90 deg 1.0 kΩ to COM



UNIDIRECTIONAL ENCODERS

(Type 53 Pickup, 76 Roto)

SIG A Adds; SIG B Subtracts 1.0 kΩ to COM

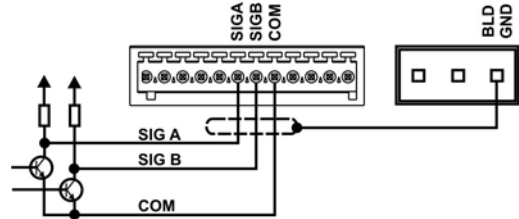


OPEN COLLECTOR (NPN)

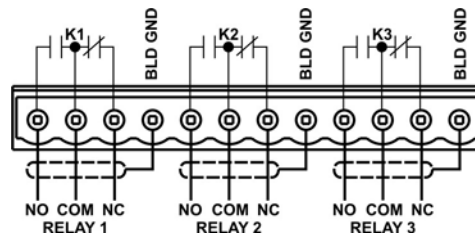
SIG A Adds; SIG B Subtracts 1.0 kΩ To COM

Customer supplied Pullup Resistor (typ)

2.2 kΩ max. to +12V; 470 Ω max to +5V



F. RELAY OUTPUTS (optional)



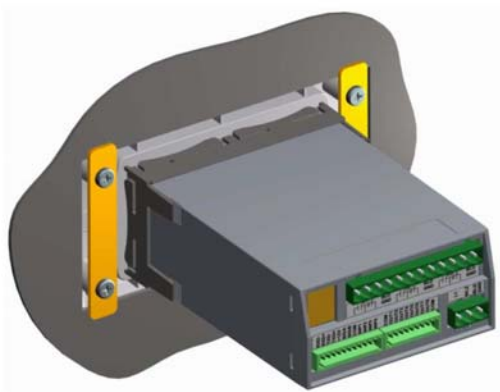
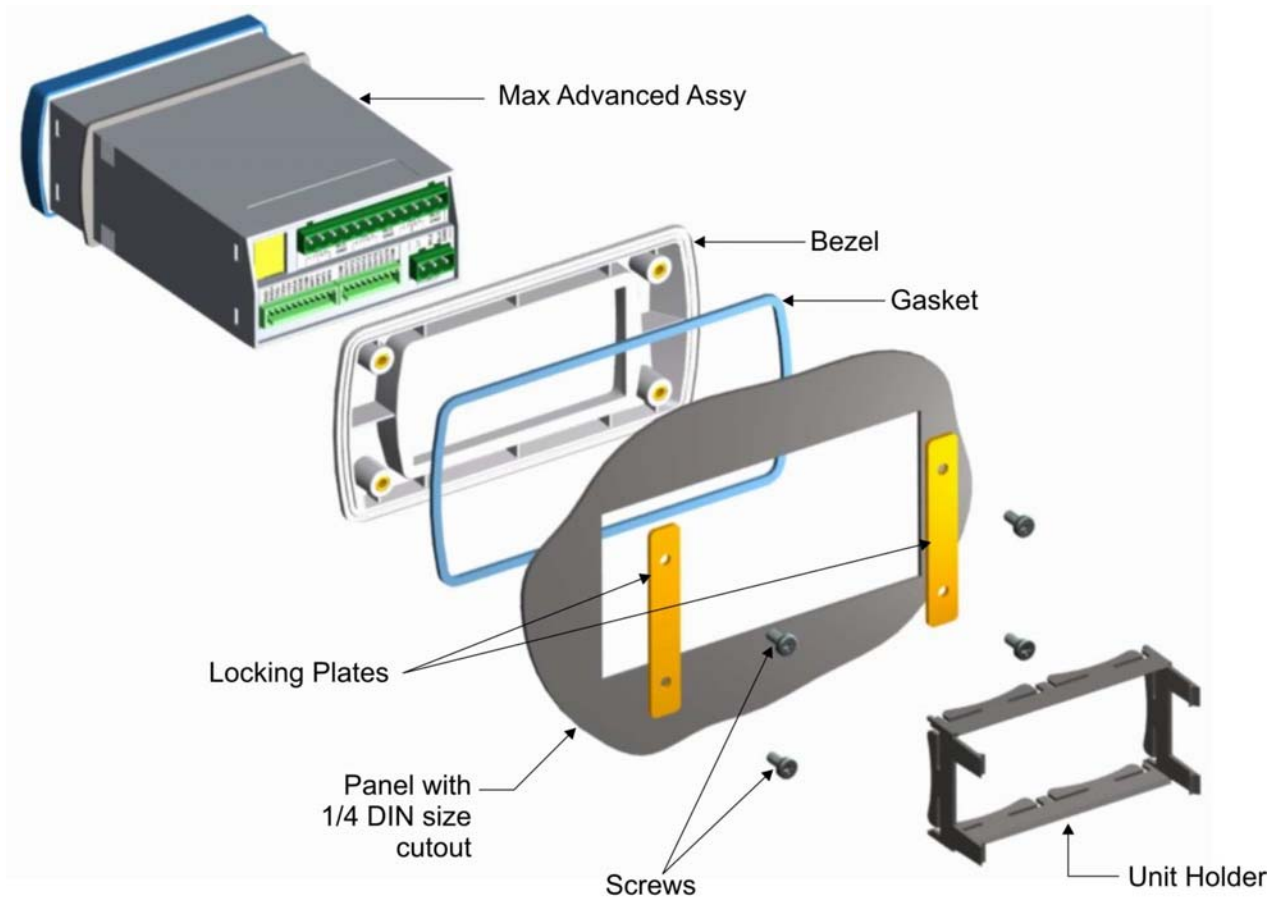
GENERAL WIRING RULES:

1. Use only Shielded cables for all signal wiring.
2. Separate signal and load switching wiring.
3. Supply AC power through a separately fused circuit
4. Terminal connector plug accepts 20 - 28 AWG wires

Replacement Arrangement: (To Mount MAX Position Advanced in 1/4 DIN panel cutout)

Follow these steps to mount **MAX** Position Advanced in place of existing Max Sr. Products, Panel cutout Size of 5.43" x 2.68".

- a) Affix adhesive gasket (if required) to panel.
- b) Insert Large Bezel from front size.
- c) Match the locking plates to the mounting holes of the bezel from inside and drive the screws.
- d) Remove the Unit holder of the **MAX** Position Advanced and slide unit through Large Bezel from front and slide back the unit holder.



Rear View



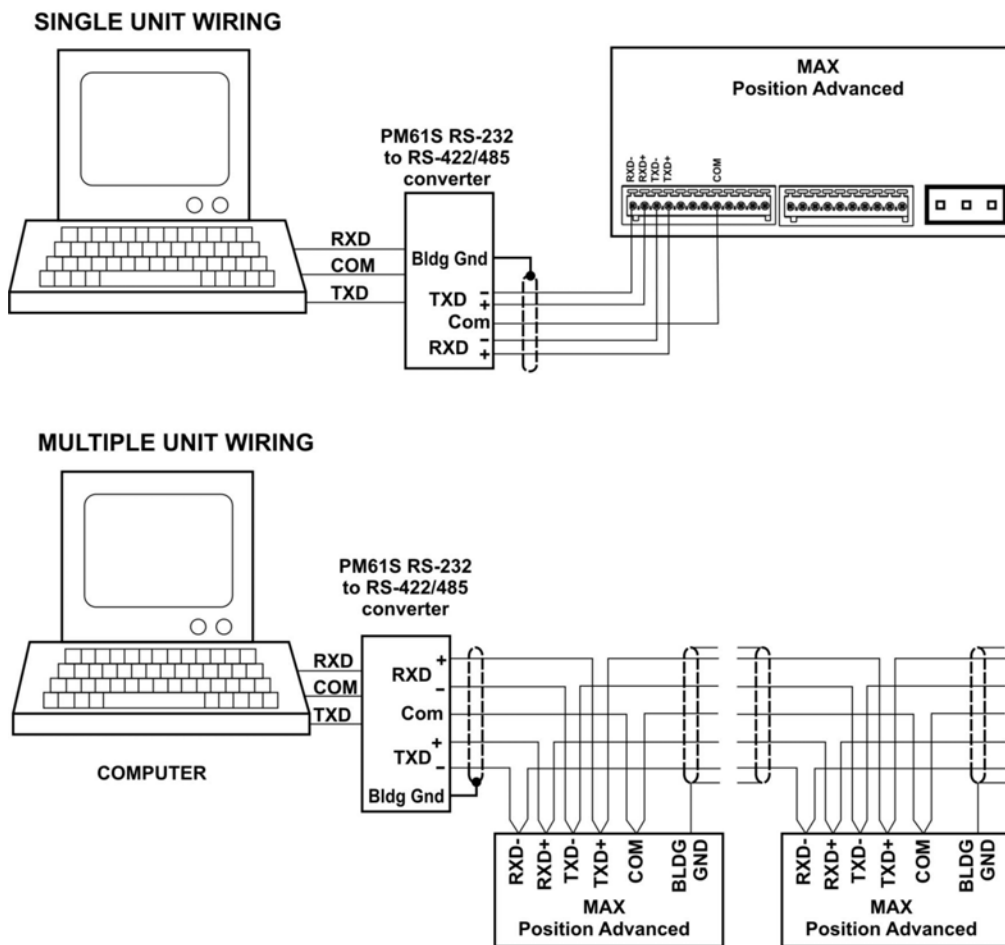
Front View

OVERVIEW

The **MAX** Position Advanced is equipped with an RS-485 Serial interface for remote data collection, programming and networking applications. Front panel keyboard and some external control inputs are supported. Additionally, facilities are provided for individual (local) and group (global) control of single and multiple unit configurations respectively in a bus oriented system. Knowledge of serial communications is required by the user who wishes to use the remote capabilities or to integrate the control into a larger system.

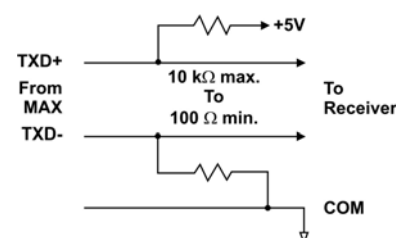
Two applications will be discussed. The first consists of a single **MAX** Position Advanced and a display terminal. It explains the use of the serial commands that mimic the keyboard operation and some control inputs. These are the LOCAL commands. Next, an application of multiple units under the control of a host computer will be discussed. The GLOBAL commands will be discussed in this section.

SERIAL CONNECTIONS



TERMINATION

The RS-485 receivers require the termination to minimize the effects of noise while the bus is not being driven. The **MAX** and PM61 products incorporate the terminations shown on the right internally. When connection is made to RS-485 device other than a **MAX** or PM61, the receiver should be terminated as shown.



CABLE SELECTION

The **MAX** serial interface uses a simple interconnect scheme and low cost wiring making it superior to parallel data transfer schemes. Through three (3) wire pairs, remote operation at distances up to 5,000 feet can be implemented. The following general guidelines should be observed.

1. Use #24 AWG twisted pair, overall shielded cable.
2. Use a "daisy chained" connection scheme for bus systems.

3. If a "multidrop" system is used, keep the drop length at 10% of the main line.
4. Tie the cable shield to BUILDING GROUD at the MAX end of the cable.
5. Crimp both the wires to a common lug for Multiple unit wiring.

RECOMMENDED CABLE TYPES:

Belden #9503
Alpha #5493

PROTOCOL : Modbus RTU

Modbus is the one of the industrial standard protocol. There are two types of Modbus implementation, one is 'ASCII' and other is 'RTU', since RTU (Remote Terminal Unit) is the more popular, **MAX** Count-Advanced has supported 'Modbus RTU' Protocol.

Modbus RTU protocol is supported by almost all industrial standard automation products like PLCs , Motor Drives, DCS, and SCADA etc.

Modbus is a Message based master-slave type protocol, where as there is a one master on a multi-drop communication bus and several slaves connected which are addressed as per their unique slave id. The master sends a query to slaves to read the data from slave as well as writes data on the slave.

are 32 bit long integers, the modbus master need to read two concurrent integer words and combine them to form a 32 bit long integer for processing.

Following is an example of how to do it.

Assume that the value of the Reference is 123456. The Hex value will be 1E240H. The Holding Register address of Reference is (40000 : 40001) and hence, address 40000 will contain 01h (Most Significant word) and address 40001 will contain E240h value (Least significant word).

Note:

Ensure to switch off & on the unit after editing the programming parameters through the MODBUS commands.

Following is the serial port specifications:-

Baud Rate:- Programmable as OFF (OFF= no communication) or 1200, 2400, 4800, 9600
Data format:- 8 bit , no parity, 1 start bit, 1 stop bit

- | |
|--|
| <ol style="list-style-type: none">1. PLC: Programmable Logic controller,2. DCS Distributed Control Systems3. SCADA: Supervisory controls & Data Acquisition. |
|--|

Supported Modbus Queries: **MAX** Position Advanced supports the three types of modbus commands,

1. Command 03 (Read Holding Register)
2. Command 16 (Write Holding Registers)
3. Command 04 (Read Input Register)

Description of modbus commands:-

Command 03 (Read Holding Register)

Read Multiple Holding Registers.

This command will allow the master to read Programmed Parameters like presets settings etc. Using this command maximum 2 numbers of 16 bit integers can be read together in single query. That means, 3 or more holding register read can not be done in a single query. Multiple queries can be sent for different address to read the data from instrument. Since most of the variables

Command 03...

Format of command as per above example where Reference is having 123456 value
 Following will be a query from master followed by the response from the slave.

Byte No	Hex Value	Description	Remarks
1	01	Slave ID	Should be matching with Slave ID set on the instrument
2	03	Command to read holding reg.	
3	00	Starting Address Hi byte	Address of the register to read 0000= Reference Hi, 0001 = Reference Lo etc.
4	00	Starting Address Lo byte	
5	00	Number of Registers Hi byte	Number of registers to read in single command. Can not be greater than 0002 for MAX products.
6	02	Number of Registers Lo byte	
7	CRC Lo	CRC Lo byte	16 bit CRC, Data validation code
8	CRC Hi	CRC Hi byte	

Following will be the Response from the instrument. Multiple slave units may be connected to Modbus RS485 bus, the instrument with Slave ID=1 will respond to this query.

Byte No	Hex Value	Description	Remarks
1	01	Slave ID	Should be matching with Slave ID set on the instrument
2	03	Command to read holding reg.	
3	04	Number of bytes of data being sent	
4	00	Hi byte of requested register (40000 in this case)	
5	01	Lo byte of requested register (40000 in this case)	Data of the requested register
6	E2	Hi byte of requested register (40001 in this case)	
7	40	Lo byte of requested register (40001 in this case)	
8	CRC Lo	CRC Lo byte	16 bit CRC, Data validation code
9	CRC Hi	CRC Hi byte	

Command 16: (WRITE Holding Registers)

This Command is used to write/Edit programmable Parameters. Following example illustrates how to write P1 the values 345678 .

P1 setting value 345678 = 5464E hex.

Following is the Query through which SC and P1 values will be edited

Byte No	Hex Value	Description	Remarks
1	01	Slave ID	Should be matching with Slave ID set on the instrument
2	16	Command to Write holding reg.	
3	00	Hi byte of requested register (40000 in this case)	For 2 numbers of registers, 4 bytes of data . will be sent
4	00	Lo byte of requested register (40000 in this case)	
5	00	Hi byte of requested number of registers.	Number of Registers to update (Max 2)
6	02	Lo byte of requested number of registers.	
7	00	Hi byte of Data integer	Data for reg. 40000
8	05	Lo byte of Data integer	
9	46	Hi byte of Data integer	Data for Reg. 40001
10	4E	Lo byte of Data integer	
11	CRC Lo	CRC Lo byte	16 bit CRC, Data validation code
12	CRC Hi	CRC Hi byte	

Following will be the Response from the instrument. Multiple slave units may be connected to Modbus RS485 bus, the instrument with Slave ID=1 will respond to this query as follows.

Byte No	Hex Value	Description	Remarks
1	01	Slave ID	Should be matching with Slave ID set on the instrument
2	16	Command to Write holding reg.	
3	00	Hi byte of requested register (40000 in this case)	
4	00	Lo byte of requested register (40000 in this case)	
5	00	Hi byte of requested number of registers.	
6	02	Lo byte of requested number of registers.	
7	CRC Lo	CRC Lo byte	16 bit CRC, Data validation code
8	CRC Hi	CRC Hi byte	

3. Command 04 (Read Input Register)

Command 04 works in similar way as command 03 except it reads input registers like counts Position, which is the process parameter, instead of programmable parameters like in command 03. The query and response is exactly same as command 03, except that the command field will have 04 instead of 03 and the data transaction will be related to input registers instead of holding registers. The process parameter like Reference cannot be edited.

Following is the Modbus Address Table for Input registers:-

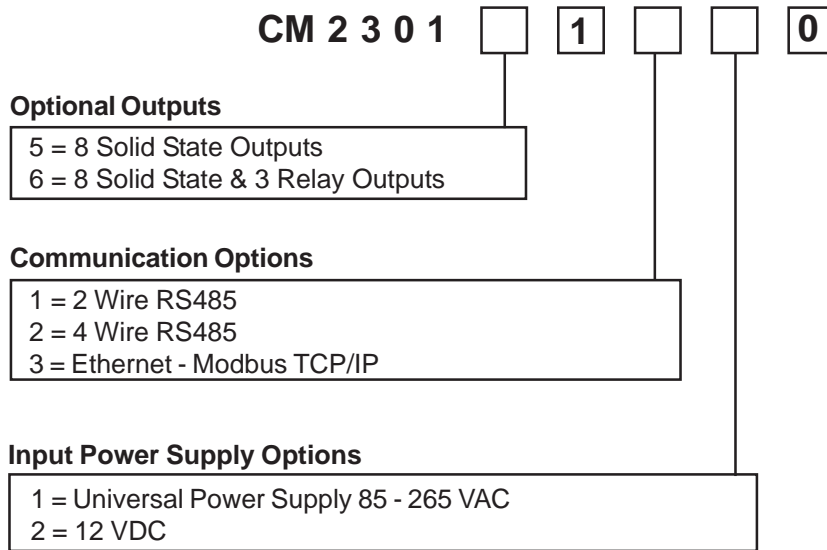
Address	Description	Remarks
30000	Position Hi	MSB of the measured process position.
30001	Position Lo	LSB of the measured process position.

Following is the Modbus Address Table for Holding registers:-

Address	Description	Remarks
40000	Reference Hi	MSB of the Reference. The Reference value should not exceed 999999 (F423Fh) and should not be less than -999999(FFF0 BDC1). If the value exceeds the limit, Reference will be replaced by the default value 000000.
40001	Reference Lo	LSB of the Reference. The Reference value should not exceed 999999(F423Fh) and should not be less than -999999(FFF0 BDC1). If the value exceeds the limit, Reference will be replaced by the default value 000000.
40002	Preset A Hi	MSB of the Numeric value of the Preset A. The preset A value should not exceed 999999(F423Fh) & should not be less than -999999 (FFF0 BDC1). If the value exceeds the limit, Preset A value will be replaced by the default value 000000.
40003	Preset A Lo	LSB of the Numeric value of the Preset A. The preset A value should not exceed 999999(F423Fh) & should not be less than -999999 (FFF0 BDC1). If the value exceeds the limit, Preset A value will be replaced by the default value 000000.
40004	Preset B Hi	MSB of the Numeric value of the Preset B. The preset B value should not exceed 999999(F423Fh) & should not be less than -999999 (FFF0 BDC1). If the value exceeds the limit, Preset B value will be replaced by the default value 000000.
40005	Preset B Lo	LSB of the Numeric value of the Preset B. The preset B value should not exceed 999999(F423Fh) & should not be less than -999999 (FFF0 BDC1). If the value exceeds the limit, Preset B value will be replaced by the default value 000000.
40006	Preset C Hi	MSB of the Numeric value of the Preset C. The preset C value should not exceed 999999(F423Fh) & should not be less than -999999 (FFF0 BDC1). If the value exceeds the limit, Preset C value will be replaced by the default value 000000.
40007	Preset C Lo	LSB of the Numeric value of the Preset C. The preset C value should not exceed 999999(F423Fh) & should not be less than -999999 (FFF0 BDC1). If the value exceeds the limit, Preset C value will be replaced by the default value 000000.

40008	Preset D Hi	MSB of the Numeric value of the Preset D. The preset D value should not exceed 999999(F423Fh) & should not be less than -999999 (FFF0 BDC1). If the value exceeds the limit, Preset D value will be replaced by the default value 000000.
40009	Preset D Lo	LSB of the Numeric value of the Preset D. The preset D value should not exceed 999999(F423Fh) & should not be less than -999999 (FFF0 BDC1). If the value exceeds the limit, Preset D value will be replaced by the default value 000000.
40010	Input Calibrator Hi	MSB of the Numeric value of the Input Calibrator. The Input Calibrator value should not exceed 999999(F423Fh) & should not be less than 0. If the value exceeds the limit, the input calibrator will be replaced by the default value 1.00000.
40011	Input Calibrator Lo	LSB of the Numeric value of the Input Calibrator. The Input Calibrator value should not exceed 999999(F423Fh) & should not be less than 0. If the value exceeds the limit, the input calibrator will be replaced by the default value 1.00000.
40012	Decimal Point Hi	MSB of the Numeric value. Default value 0.
40013	Decimal Point Lo	LSB of the Display point position for process position value & preset. The value of Decimal point position should not exceed 4 and should not be less than 0. If the value exceeds, it will be replaced by 0. In MAX series, a decimal point to be displayed is programmable, which makes long integer to appear as float. For Example if the Counter value displayed is 123.456, it is stored as 123456 in modbus register and treated by embedded software as 123456 only. The decimal point is just placed on 7 segment display to appear it to be 123.456. While reading these all values one have to consider decimal point applicable (i.e. 2nd position, 3rd positions etc.) if Modbus value is read as 123456, and decimal point is on 2nd position, then actual display on PC screen should be 1234.56. The software has to divide the value by 100 and display it as "%6.2f" format. While writing the values the same thing should be done. If user enters 1234 (can be 1234.00) as a value and if decimal point is on 2nd position, then it is interpreted as 1234.00 and 123400 value should be written. The software should read decimal point register to determine decimal point position.
40014	Operation Hi	MSB of the Numeric value. Default value 0.
40015	Operation Lo	LSB of the Numeric value used to select the A-B,A+B or Quad. The Operation value should not exceed 2 and should not be less than 0. If the value exceeds, it will be loaded with A - B.
40016	Logic Hi	MSB of the Numeric value. Default value 0.
40017	Logic Lo	LSB of the Quad logic used. The value of the Quad logic can be 0, 1 or 2. If the value given is greater then 2 or less than 0, then the default value of 0 (LOGICONE) is loaded.

40018	Front Panel Rst Hi	MSB of the Numeric value. Default value 0.
40019	Front Panel Rst Lo	LSB of the Numeric value used to select the Front Panel reset. The value can be either 0(FRNT_PANL_RST_OFF) or 1(FRNT_PANL_RST_ON) and should not be less than 0. If the value exceeds, the default value of 0 is loaded.
40020	Stop_Hold_Mode Hi	MSB of the Numeric value. Default value 0.
40021	Stop_Hold_Mode Lo	LSB of the Numeric value used to select the Stop count or display Hold function via external input. The value can be either 0(STOP_MODE) or 1 (HOLD_MODE) and should not be less than 0. If the value exceeds, the default value of 0 is loaded.
40022	Baud_Select Hi	MSB of the Numeric value. Default value 0.
40023	Baud_Select Lo	LSB of the Numeric value used to select the Baud rate for Serial communication. The value cannot exceed 4 and should not be less than 0. If the value exceeds, the default value 0 is loaded which terminates the communication.
40024	Serial_ID Hi	MSB of the Numeric value. Default value 0.
40025	Serial_ID Lo	LSB of the Numeric value used to program the serial ID (01-32). The value should not exceed 32. If the value exceeds, the Serial ID will be replaced by 32.



WARRANTY

Standard products manufactured by the Company are warranted to be free from workmanship and material for a period of one year from the date of shipment, and products which are defective in workmanship or material will be repaired or replaced, at the option of the Company, at no charge to the buyer. Final determination as to whether a product is actually defective rests with the company. The obligation of the company hereunder shall be limited solely to repair and replacement of products that fall within the foregoing limitations, and shall be conditioned upon receipt by the company of written notice of any alleged defects or deficiency promptly after discovery within the warranty period, and in the case of components or units purchased by the company, the obligation of the company shall not exceed the settlement that the company is able to obtain from the supplier thereof. No products shall be returned to the company without its prior consent. Products which the company consents to have returned shall be shipped F.O.B. the Company's factory. The Company cannot assume responsibility or accept invoices for unauthorized repairs to its components, even though defective. The life of the products of the Company depends, to a large extent, upon the type of usage thereof, and THE COMPANY MAKES NO WARRANTY AS TO FITNESS OF ITS PRODUCTS FOR SPECIFIC APPLICATIONS BY THE BUYER NOR AS TO PERIOD OF SERVICE UNLESS THE COMPANY SPECIFICALLY AGREES OTHERWISE IN WRITING AFTER THE PROPOSED USAGE HAS BEEN MADE KNOWN TO IT.

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- Include
1. Description of the problem
 2. Name of the responsible person
 3. Purchase order number
 4. Return shipping instructions.

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