TECHNICAL MANUAL

200853

MAX Tach Advanced

RATE and DRAW Indicator with Alarms

MAX Tach Advanced is a Powerful RATE and DRAW Indicator with programmable Alarms. **MAX** Tach Advanced features guided programming using English prompts and annunciators for easy setup and operation. Human engineering, high speed dual channel operation, advanced packaging and its ability to communicate make **MAX** Tach Advanced is clearly the best choice for industrial Rate and Draw applications.

FEATURES

- Time Interval Measurement Technique
- Dual High speed Rate Inputs
- Automatic Averaging
- Dual Programmable Calibrators on Rate inputs
- Programmable Rate and Draw Display modes
- Control Inputs (Unlatch and Disable)
- Six Solid State Alarm Outputs
- 4 Wire / 2 Wire RS-485 Provides LOCAL and REMOTE process Control Capability Modbus RTU protocol
- Non-Volatile Memory (FRAM) for Programmed parameters
- Built In Self- Diagnostics
- Eight Alpha Numeric, 14 Segments LED display

KEY SPECIFICATIONS

- Eight Decade Display with Sign.
- Two Selectable Rate Displays
- Selectable Draw Displays : A-B, A/B, (A-B)/A, (A-B)/B
- 0.2 Hz to 30 kHz Input frequency range
- Individual High and Low Alarms for Rate A, Rate B and Draw Measurements
- Alarms Programmable as Follows, Pulsed or Latched
- 0.005% Accuracy; 0.001% stability
- +12VDC @ 175mA Transducer Supply
- 85-265 VAC Operation (12 VDC Optional)

INDEX TO CONTENTS

Eagle Signal

OVERVIEW ...

PLASTIC ENCLOSURE
- Light Weight
- Easy to assemble

LED DISPLAY
- 8 Alpha Numeric, 14 Segments, 0.4” high

SEALED FRONT PANEL
- NEMA 4 Rated
- Oil & Water tight
- Easy Cleaning

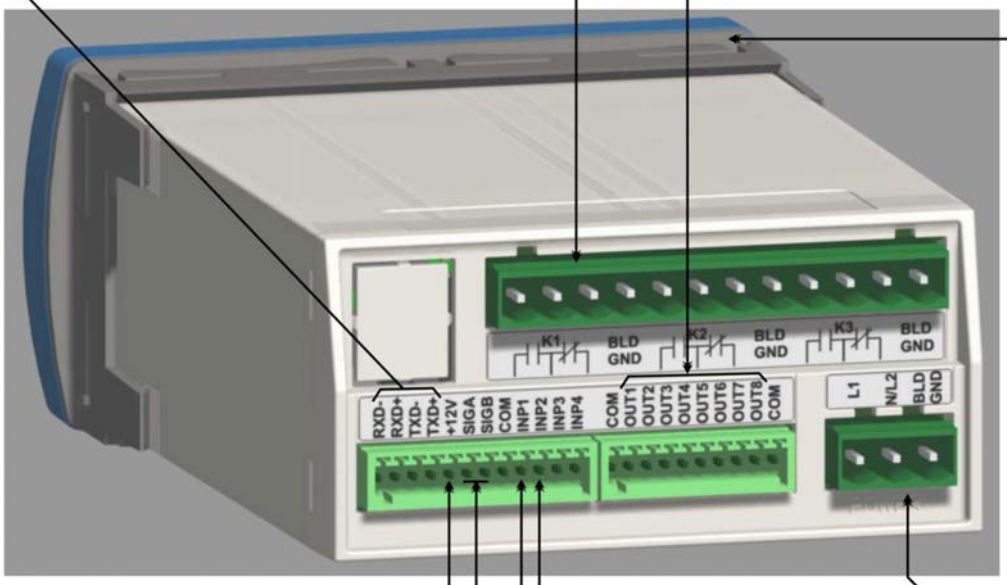
PROGRAMMING
- Data entry through 6 keys
- Menu Selection Programming
- Display prompts are in English
- No internal Programming
- User configurable

OVERVIEW ...

RELAY OUTPUTS
- Three optional relay outputs in addition to the solid state outputs described at right

SOLID STATE OUTPUTS (OUT1 to OUT6)
- One output per Alarm
  Term. OUT1 = A LO Term. OUT2 = A HI
  Term. OUT3 = B LO Term. OUT4 = B HI
  Term. OUT5 = D LO Term. OUT6 = D HI
- Gang programmed as Following, Pulsed (120 msec), or Latched
- High Voltage & Current drivers

SERIAL DATA I/O
- 4 Wire / 2 Wire RS-485
- Up to 32 units may be bussed together
  See Page-6, lines 14 - 15 for Programming
  See pages 17-23 for Operation



Neoprene Gasket Seal

TRANSDUCER SUPPLY (+12V)
- 12 VDC @ 175 mA
- Short Circuit Protected

DISABLE (INP2)
- Inhibits the Up and Down keys in the Run Mode.
- Prevents any tampering with the Run Mode display.

POWER INPUT
- 85-265 VAC Universal
- 12 VDC optional
- Memory is retained indefinitely when power is off
- Built-in Line Filter

SIG A and SIG B INPUTS
- Operates as Rate A, Rate B and Draw
- 0.2Hz to 30 kHz operation (combined)

UNLATCH (INP1)
- Forces outputs (1 - 6) Off.
- Can be used to Inhibits Alarms or to reset Latched Alarms

SPECIFICATIONS ...

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

Accessory Supply: 12 VDC @ 175 mA.

Tachometer Operation:

Modes:	Rate A, Rate B and Draw (A-B, A/B, A-B/A and A-B/B)
Selection:	Front Panel selectable with UP and DOWN keys.
Input Rate:	0.2 Hz. Min to 30 kHz max. (30 kHz combined A & B)

Calibrator:

Type:	Dual 5 Decade, Range : 0.0001 to 999.99 individually programmable for A and B inputs.

Signal A and B Inputs:

Input Frequency:	0.2 Hz to 30 kHz max,
Input Type:	Single ended, Current Source
Input Logic:	x1
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 max.
Input Type:	Single ended, current sinking
Input Logic:	Level sensitive
Input High Level:	10 VDC min. to 20 VDC max.
Input Low Level:	0 VDC min. to 2 VDC max.
Input Impedance:	4.7kΩ pullup to +12 VDC
Input Current:	2.5 mA. Steady state
Input Response:	25 ms. make and break time

Display:

Decades:	Eight Alpha Numeric, 0.4" red LED
Annunciators:	PGM, RT A, RT B, DRAW, A HI, A LO, B HI, B LO, D HI, D LO
Decimal Point:	User programmable Range: x.xxxx to xxxxx

Keyboard: Sealed tactile feel, 6 positions

Program Security: Program LOCK for lines 4-24

Control Outputs:

Type:	6 Solid State outputs, 100mA sink max., 24 VDC max.	
Logic:	Programmable for Following, Pulsed (120 msec.) or Latched.	
Assignment:	(OUT 1)	A LO
	(OUT 2)	A HI
	(OUT 3)	B LO
	(OUT 4)	B HI
	(OUT 5)	D LO
	(OUT 6)	D HI

Serial Interface:

Type:	RS-485 compatible (4 or 2 wire options with modbus support)
Baud Rate:	Selectable; 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)
3. Display does not fit (Displays RA ERROR, RB ERROR, DR ERROR if Rate A, Rate B and Draw does not fit in the display)

Pess RST/CLR To clear Error Code

FRAM Error Codes

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

Note: Power cycle to clear the FRAM error

FRONT PANEL CONTROLS...

ANNUNCIATORS

PROGRAM MODE INDICATOR

- PGM constantly illuminated in the PROGRAM mode

DISPLAY ANNUNCIATORS

- Used for both RUN and PROGRAM modes
- Illuminated as : RT A, RT B or DRAW

ALARM ANNUNCIATORS

- Used for both RUN and PROGRAM modes
- Illuminated as : A HI, A LO, B HI, B LO, D HI and D LO

MAIN DISPLAY

- Displays Prompts and Data
- Used with Annunciators for programming

DOWN KEY

- Sequences down through menu options of RUN 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 menu
- Sequences Up through menu options of PROGRAM mode
- Increment the number in edit mode (Highlighted digit)

RIGHT KEY

- Sequences to the right in individual Programming menus or sequences highlighting to the right digit in PROGRAM menu when highlighting enabled.
- Selects decimal point position

RESET / CLEAR

- Clears display in the PROGRAM modes

RUN/PGM

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

KEY

- Used to enter edit mode by highlighting
- Save the value in edit mode

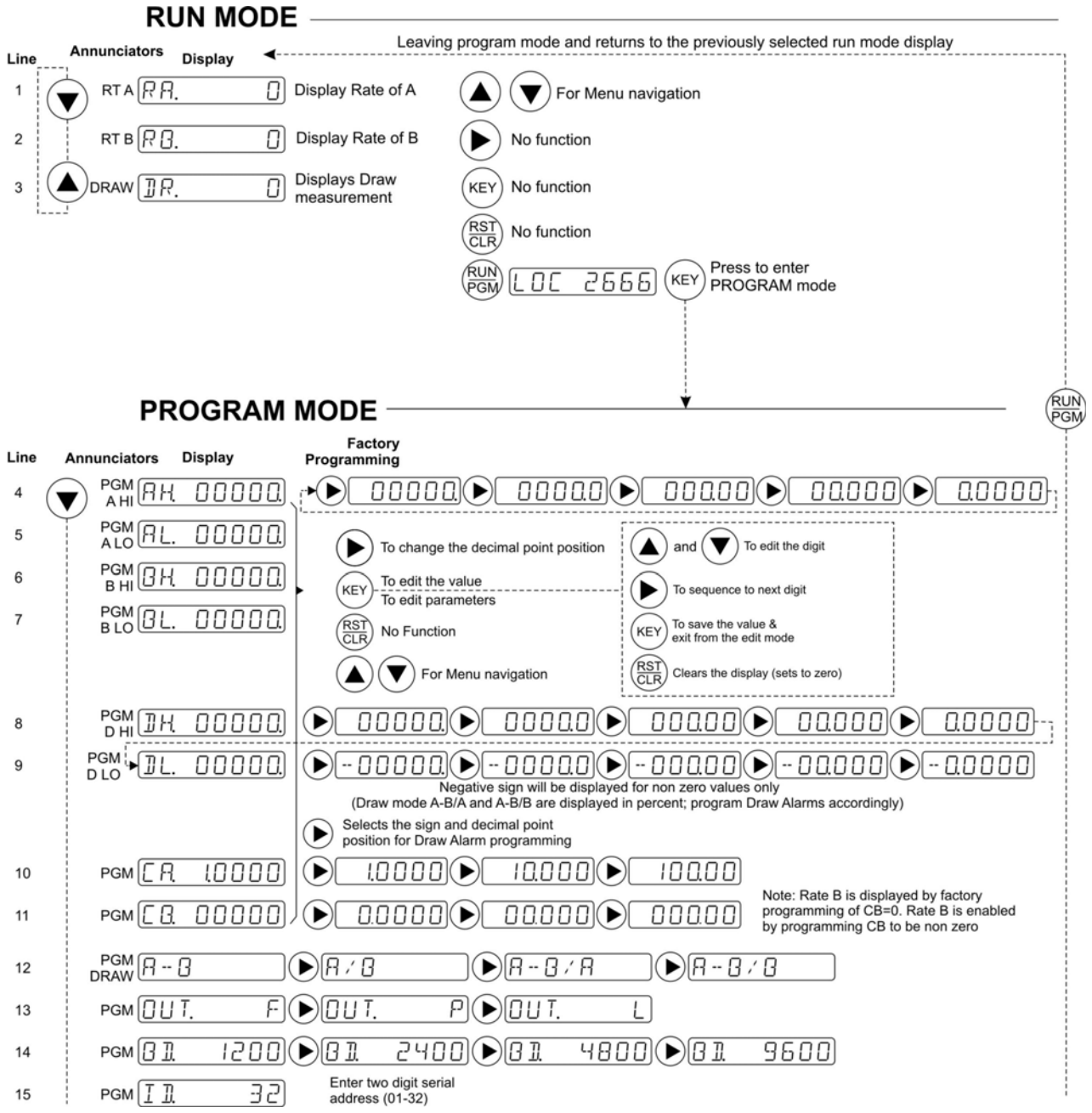
PROGRAMMING ...

RUN MODE:

LINE	FUNCTION	DESCRIPTION
1	RATE A	Display of Rate A input.
2	RATE B	Display of Rate B input.
3	DRAW	Display of Draw measurement (as selected on line 12)

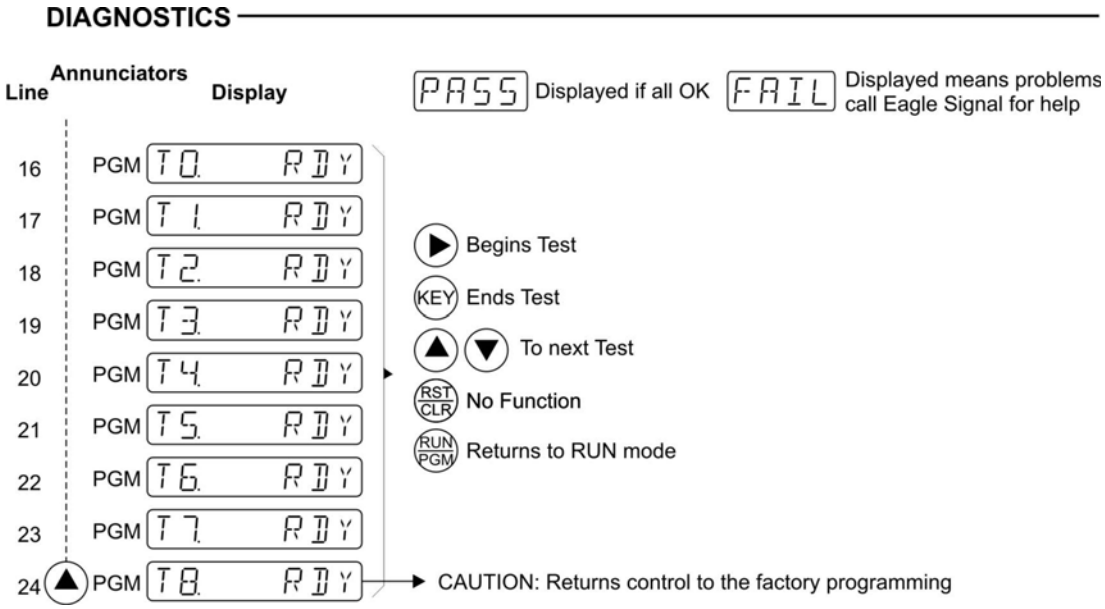
PROGRAM MODE

4	A HIGH ALARM	Numeric value of Rate A High Alarm.
5	A LOW ALARM	Numeric value of Rate A Low Alarm.
6	B HIGH ALARM	Numeric value of Rate B High Alarm.
7	B LOW ALARM	Numeric value of Rate B Low Alarm.
8	DRAW HIGH ALARM	Numeric value of Draw measurement High Alarm.
9	DRAW LOW ALARM	Numeric value of Draw measurement Low Alarm.
10	CALIBRATION A	Numeric constant that multiplies Rate A input.
11	CALIBRATION B	Numeric constant that multiplies Rate B input.(Set to 0 to disable B input).
12	DRAW MODE	Select: A-B, A/B, A-B/A or A-B/B (A-B/A and A-B/B displayed in percent).
13	OUTPUT MODE	Select Alarm output mode: Follows, Pulsed or Latched (common to all outputs).
14	BAUD RATE	Serial baud rate. Selectable 1200, 2400, 4800 or 9600 baud.
15	ID NUMBER	Serial ID number. Program unit serial ID (01 - 32).


RUN MODE
Leaving program mode and returns to the previously selected run mode display
Line
Annunciators
Display
1
RT A
RA. 0
Display Rate of A
2
RT B
RB. 0
Display Rate of B
3
DRAW
DR. 0
Displays Draw measurement
For Menu navigation
No function
KEY
No function
RST CLR
No function
RUN PGM
LOC 2666
KEY
Press to enter PROGRAM mode
PROGRAM MODE
RUN PGM
Line
Annunciators
Display
Factory Programming
4
PGM A HI
AH. 00000
00000. 0000.0 000.00 00.000 0.0000
5
PGM A LO
AL. 00000
6
PGM B HI
BH. 00000
7
PGM B LO
BL. 00000
To change the decimal point position
KEY
To edit the value
To edit parameters
RST CLR
No Function
For Menu navigation
and
To edit the digit
To sequence to next digit
KEY
To save the value & exit from the edit mode
RST CLR
Clears the display (sets to zero)
8
PGM D HI
DH. 00000
00000. 0000.0 000.00 00.000 0.0000
9
PGM D LO
DL. 00000
-00000. -0000.0 -000.00 -00.000 -0.0000
Negative sign will be displayed for non zero values only
(Draw mode A-B/A and A-B/B are displayed in percent; program Draw Alarms accordingly)
Selects the sign and decimal point position for Draw Alarm programming
10
PGM
CA 1.0000
1.0000 10.000 100.00
11
PGM
CB 00000
0.0000 00.000 000.00
Note: Rate B is displayed by factory programming of CB=0. Rate B is enabled by programming CB to be non zero
12
PGM DRAW
A-B
A/B
A-B/A
A-B/B
13
PGM
OUT. F
OUT. P
OUT. L
14
PGM
BD. 1200
BD. 2400
BD. 4800
BD. 9600
15
PGM
ID. 32
Enter two digit serial address (01-32)

DIAGNOSTICS

LINE	DIAGNOSTIC	DESCRIPTION
16	TEST 0	Keyboard Test: Functional test of all keys.
17	TEST 1	FRAM Memory Test. Operational Read / Write test of FRAM
18	TEST 2	Input Tests: Test for “Closures” on Inputs.
19	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’.
20	TEST 4	Display Test: Illuminates all segment and digit combinations.
21	TEST 5	PROM Memory test: Checksum comparision for program memory.
22	TEST 6	Version code Test: Displays date code version of firmware.
23	TEST 7	Serial Test: Provides loop-back test of the serial transmitter and receiver (will indicate ‘FAIL’ if the loop back connectors are not provided).
24	TEST 8	Returns controller to the factory programmed state.



Test T0: Display shows: **T0. RDY**
Press RIGHT key (in line 16)
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
RUN/PGM	RUN KEY
RST/CLR	RESET KEY
KEY	Exits from the menu shows T0 RDY

Test T1: Display shows: **T1. RDY**
Press RIGHT key (in line 17)
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 18)
Then it will display **IN** and the inputs connected to it and it will display the following for the inputs when externally pulled low or high.

Inputs	**Display**
SIG A	A
SIG B	B
UNLATCH	1
DISABLE	2

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 19)
Then the display shows **OUTTST 1** and by scrolling up and down **OUTTST 2, OUTTST 3, OUTTST 4, OUTTST 5, OUTTST 6** are displayed**,** press **RIGHT** key to turn the corresponding Solid State / Relay output turn ON.
Press **RST/CLR** to make Solid State / Relay output turn 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 20)
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 21)
Shows FAIL / PASS indicating Flash test 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 22)
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 23)
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 24)
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 **KEY** key, the first digit Highlights, which indicate edit mode. Enter value by using UP and DOWN key, then press Right key which will take the highlighting to next digit. After entering the value, to confirm or exit from edit mode, press **KEY** key once again.
Pressing the Right key when not in edit mode will change the decimal point position for menus from A High alarm to Calibration B. For Draw alarms, pressing Right key when not in edit mode will not only change the decimal point position but also changes the sign for a non – zero value.
Pressing the Right key for menus from DRAW MODE to BAUD RATE will scroll to corresponding internal modes of the menu.

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 enter the value by using UP and DOWN key 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 take to program mode.
If the LOC doesn't match with 2666 then it will return to RUN Mode.

NOTE 2:
While entering the value for a parameter, If the highlighting reaches the last digit, and upon pressing RIGHT key, then the highlighting reaches first digit.(Roll back happens).

THEORY OF OPEARATION:

The **MAX Tach Advanced** provides two simultaneous rate measurements and also computes the 'Draw' between the two rate inputs. Two independently programmable calibrators are provided to factor the incoming frequency into displayed engineering units. **MAX Tach Advanced** uses an automatic adaptive measurement technique. It is a combination of both time interval and time base techniques. This technique allows the use of both low and high resolution input devices. This technique averages the time interval between input pulses over a 0.6 sec minimum measurement cycle. The maximum period of the measurement cycle will be determined by the input pulse rate for frequencies less than 1.7 Hz. Two input pulses are required to complete a measurement cycle. At 0.2 Hz, the measurement update will be for every 5 seconds. This technique offers 50 ppm accuracy for both high and low frequency inputs. This accuracy exceeds that of most conventional tachometry devices while preserving low frequency measurement capability.

In most Rate measurement applications a single pulse-per-revolution rate input is sufficient to provide accuracy displays of the process rate. In draw applications a minimum of 60 pulses per revolution is recommended to provide accurate and stable displays of the draw measurement selected.

PROGRAMMING THE CALIBRATION CONSTANTS:

Calibration constants are computed based upon the following general formula:
Calibration= Displayed Value / frequency input.
In other words, all you need to know is the value of your input pulse rate (frequency) and how you want it displayed by **MAX Tach Advanced**. For example, if the frequency input is 2 pulses per-second and this is equal to 200 RPM then your calibration constant is 200 / 2 = 100.00.

There is no need to worry about units conversion or factoring, this is all done by the **MAX** unit. Keep in mind that the input frequency must be in units-per-second. Use the following four step procedure when computing the correction constant for your application.

1. Convert input rate into equivalent pulses-per-second. This is the denominator frequency.

2. Specify the calibrated display value for the frequency in step 1. This is the numerator. Remember to program the displayed decimal point position of the program table as required.

3. Use the formula:

$$\text{Calibration} = \frac{\text{Displayed value (From Step 2)}}{\text{Frequency input (From step 1)}}$$

4. The value computed in Step 3 must be in the range of 0.0001 to 999.99. If it is not then the input pulse rate (Pulses-per-revolution) must be changed to meet this application.

USING THE ALARMS:

Six solid state alarms are provided by the **MAX Tach Advanced**. The proper use of these alarms will allow the user to detect under-speed, over-speed, speed matching, short / long sheet length, etc. Alarms are programmed on lines 4 - 9 of the programming menu shown on pages 6 & 7. The numeric value of the alarms is programmed in same engineering units as the corresponding variable (Rate A, Rate B or Draw) they represent. Each alarm may have any numeric value within the range of the instrument. LOW ALARMS MAY BE GREATER THAN HIGH ALARMS. The decimal point position selected in the alarm programming fields is the same position displayed for the corresponding variable. For example, if the A LO and A Hi alarms show XXX . XX selected then display of Rate A will show the same resolution. Alarms are paired (A LO & A HI, B LO & B HI, D LO & D HI) and alarm pairs will always show the same decimal point position.

Alarms are pre- assigned to solid state outputs as follows :
A LO to terminal OUT1, A HI to terminal OUT2,
B LO to terminal OUT3, B HI to terminal OUT4,
D LO to terminal OUT5, D HI to terminal OUT6.

The logic of the alarm outputs is programmed on line 13 in the programming menu.
'FOLLOWS' alarm programming means that the alarms will track the process variables and will alternately 'alarm' and reset as dictated by the process.
'PULSED' alarms trigger once (for 120 ms.) each time the alarm condition is met.
'LATCHED' alarms latch when alarm conditions are met. They are reset by the UNLATCH control input. The following convention is used to explain the relationship between the alarm setpoints and process variable.

HIGH ALARM OUTPUTS ACTIVE (current sinking) when the PROCESS $\geq$ HIGH ALARM SETPOINTS

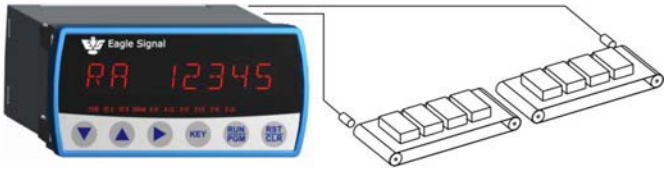
LOW ALARM OUTPUTS ACTIVE (current sinking) when the PROCESS $\leq$ LOW ALARM SETPOINTS

When power is applied or when the user switches between the PROGRAM and RUN modes, the alarms are internally disabled until the second input event is detected to prevent false alarming on incomplete measurement cycles. Further, the user should hold the alarms OFF by pulling the UNLATCH input low (switch closure to common) whenever the rate inputs are likely to be unstable (i.e., when accelerating and decelerating a load).

APPLICATIONS

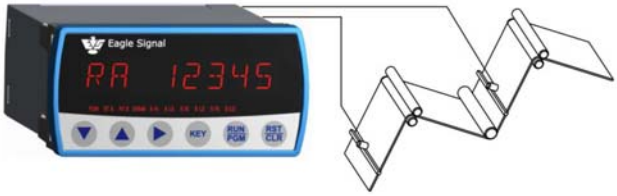
RATE A, B

DRAW A - B



DRAW A / B

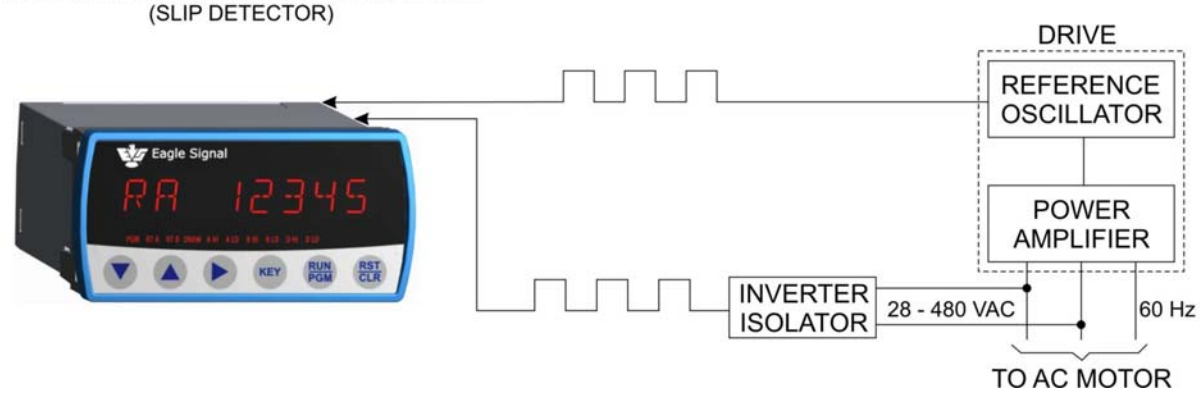
DRAW A - B / A, B



PRODUCTION RATE

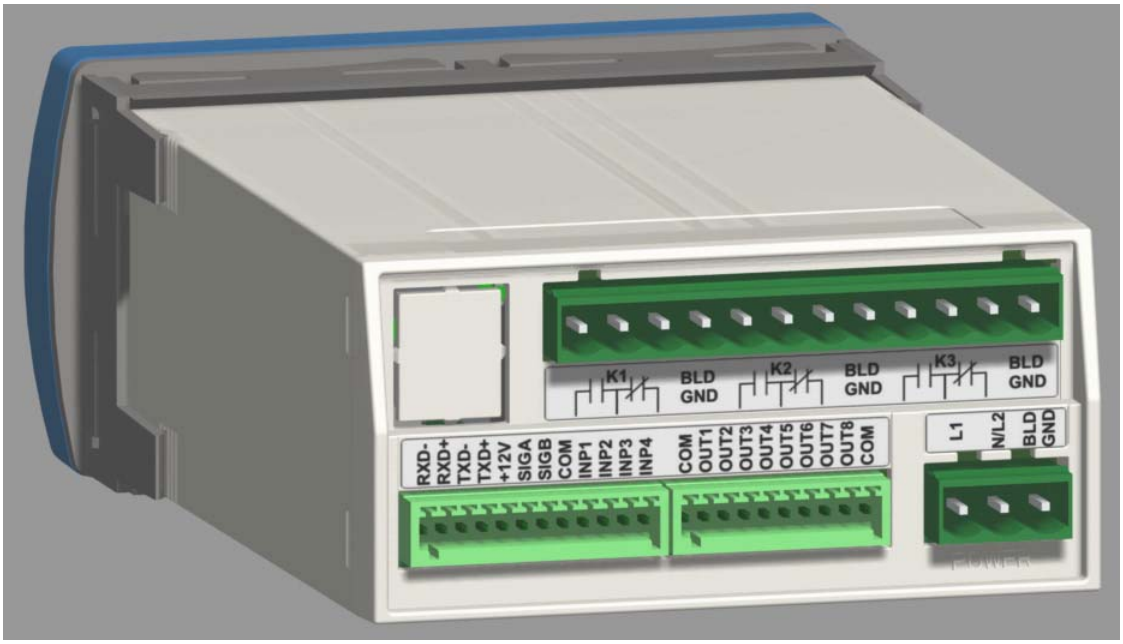
PRODUCTION RATE

AC VARIABLE SPEED DRIVE MONITOR
(SLIP DETECTOR)



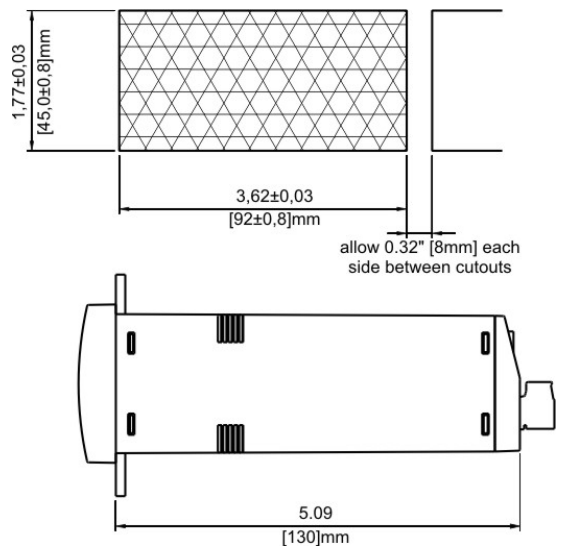
NOTES:

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.



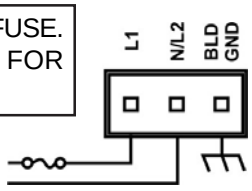
B. INPUT POWER

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

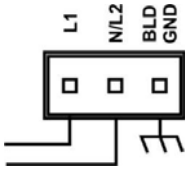
85-265 VAC, 50 / 60Hz, 20 VA



DC POWER

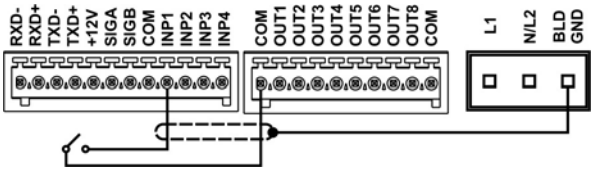
Connect +12 VDC to terminal **L1** and 12 Volt ground to terminal **N/L2**. Connect terminal **BLD GND** to BUILDING GROUND!

+12 VDC

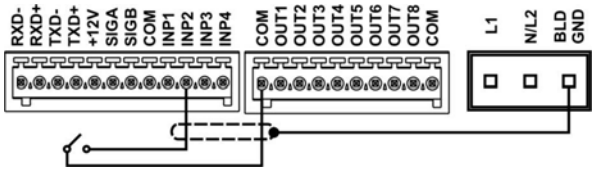


C. CONTROL INPUTS

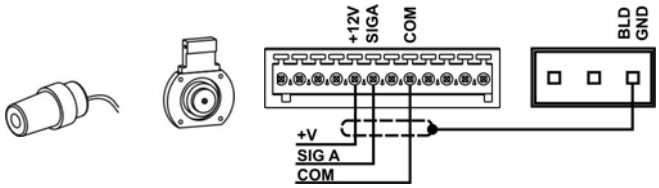
UNLATCH (Term INP1)
Level sensitive 20 Hz Response 4.7 kΩ to
+ 12 VDC (Shows '1' during input diagnostic test).



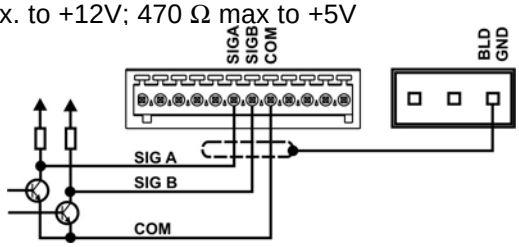
DISABLE (Term INP2)
Level sensitive 20 Hz Response 4.7 kΩ to
+ 12 VDC (Shows '2' during input diagnostic test).



MAGNETIC (ZERO SPEED) ENCODERS
(Type 53 Pickup, 76 Roto)
1.0 kΩ to COM

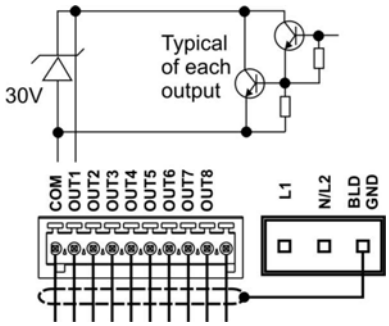


OPEN COLLECTOR (NPN)
1.0 kΩ To COM
Customer supplied Pullup Resistor (typ)
2.2 kΩ max. to +12V; 470 Ω max to +5V

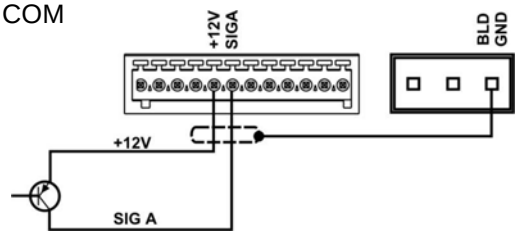


D. CONTROL OUTPUTS

A LO OUT1
A HI OUT2
B LO OUT3
B HI OUT4
D LO OUT5
D HI OUT6



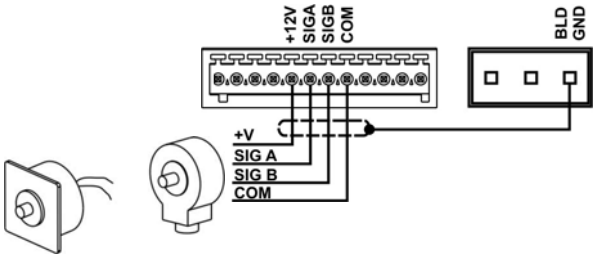
OPEN COLLECTOR (PNP)
1.0 kΩ To COM



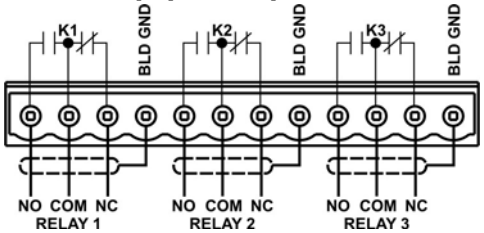
E. RATE INPUTS

OPTICAL ENCODERS
(Type 42, 62 Rotopulser)

1.0 kΩ to COM



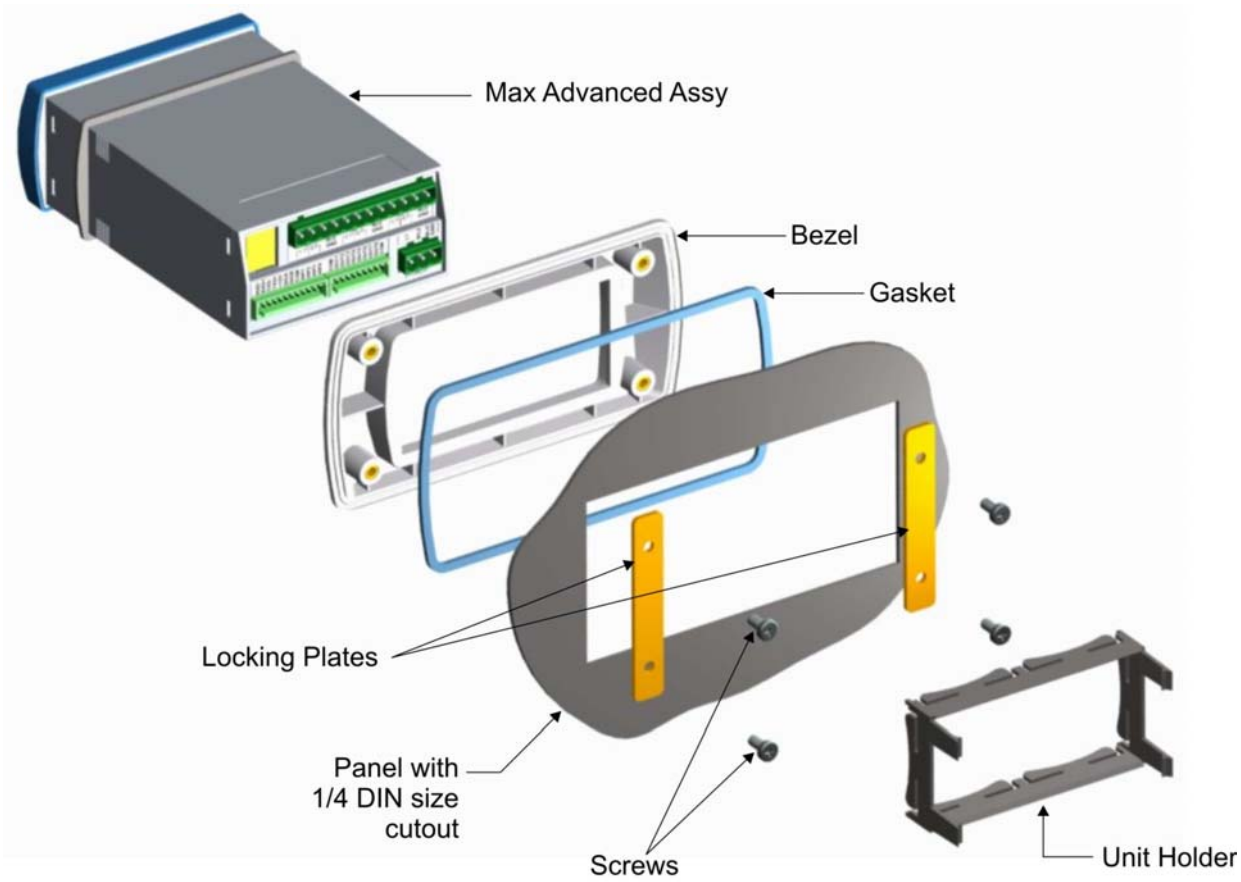
F. RELAY OUTPUTS (Optional)

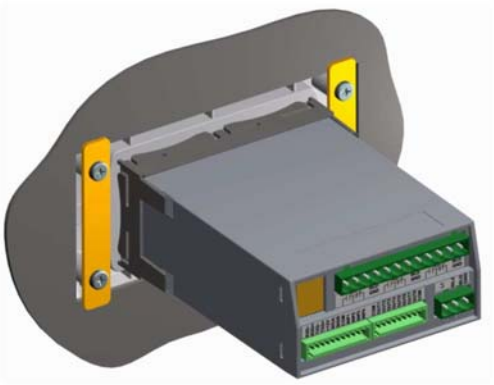


GENERAL WIRING RULES:
1. Use only Shielded cables for all signal wiring.
2. Separeat signal and load switching wiring.
3. Supply AC power through a separately fused circuit
4. Terminal connector plug accepts 20 - 28 AWG wires

Replacement Arrangement: (To Mount MAX Tach Advanced in 1/4 DIN panel cutout)
Follow these steps to mount **MAX** Tach 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** Tach Advanced and slide unit through Large Bezel from front and slide back the unit holder.





Rear View

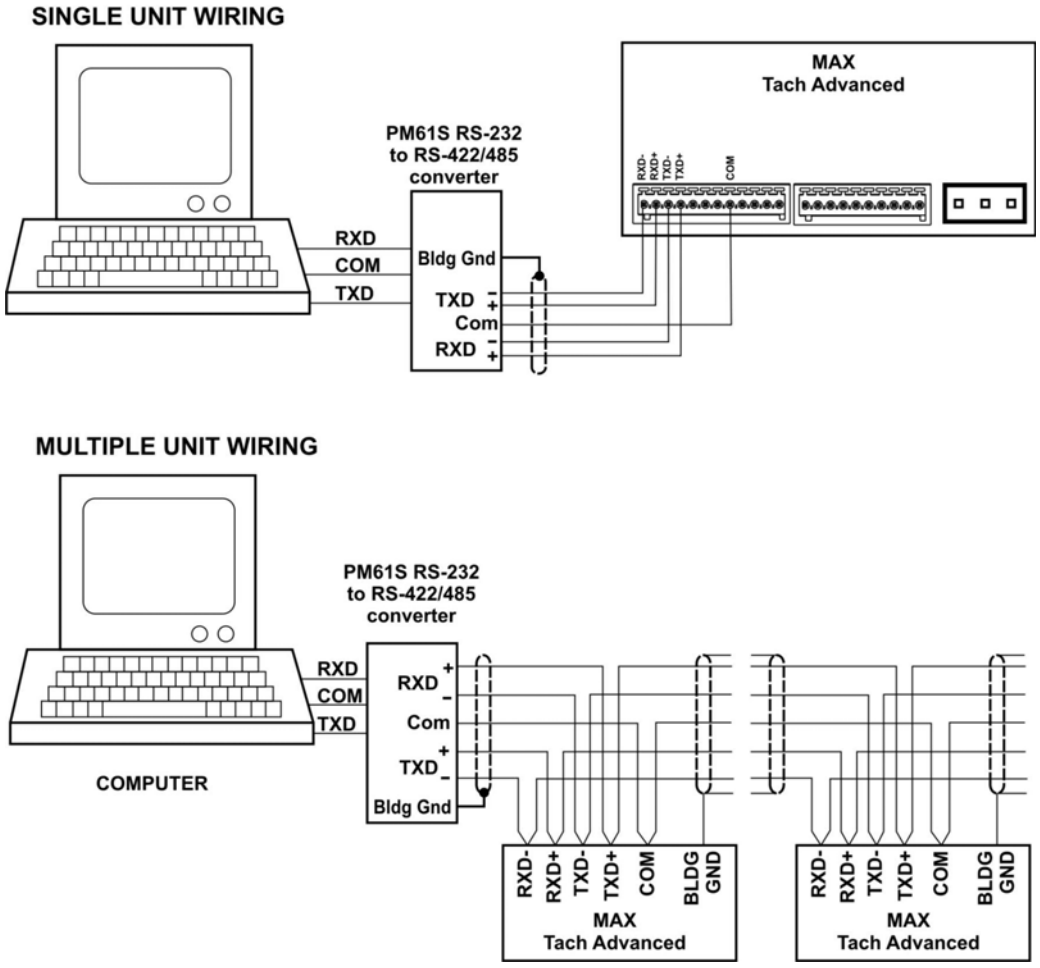
Front View

OVERVIEW

The **MAX** Tach 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.

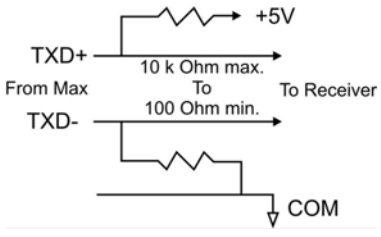
Two applications will be discussed. The first consists of a single **MAX** Tach Advanced and a display terminal. It explains the use of the serial commands that mimic the keyboard operation and some control inputs. These are the LOCAL commands. Next, an application of multiple units under the control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

Following is the serial port specifications:-

Baud Rate:- Programmable as 1200, 2400, 4800, 9600
Data format:- 8 bit , no parity, 1 start bit, 1 stop bit

Supported Modbus Queries: **MAX** Tach 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 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 A High Alarm AH is 12345. The Hex value will be 3039H. The Holding Register address of AH is (40000 : 40001) and hence, address 40000 will contain 00h (Most Significant word) and address 40001 will contain 3039H value (Least significant word).

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

1 PLC: Programmable Logic controller,
2. DCS Distributed Control Systems
3. SCADA: Supervisory controls and Data Acquisition.

Command 03…
Format of command as per above example where AH is having 12345 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= AH Hi, 0001 = AH 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	00	Lo byte of requested register (40000 in this case)	Data of the requested register
6	30	Hi byte of requested register (40001 in this case)	
7	39	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 AH the values 34567 .
AH setting value 34567 = 8707 hex.

Following is the Query through which AH 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	10	Command to Write holding reg.	
3	00	Hi byte of requested register (40000 in this case)	For 2 number 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	00	Lo byte of Data integer	
9	87	Hi byte of Data integer	Data for Reg. 40001
10	07	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	10	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 RA, RB and Draw which are the process parameters, 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 parameters like RA, RB, and Draw can not be edited.

Following is the Modbus Address Table for Input registers:-

Address	Description	Remarks
30000	Rate A Hi	MSB of the Rate A
30001	Rate A Lo	LSB of the Rate A
30002	Rate B Hi	MSB of the Rate B
30003	Rate B Lo	LSB of the Rate B
30004	Draw Hi	MSB of the Draw
30005	Draw Lo	LSB of the Draw

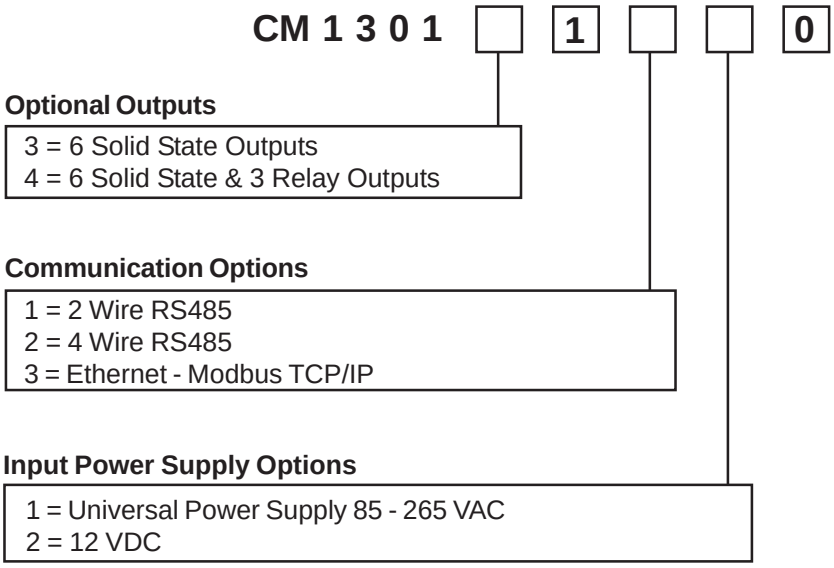
Following is the Modbus Address Table for Holding registers:-

Address	Description	Remarks
40000	Rate A Hi Alarm Hi	MSB of the Rate A Hi Alarm. The Rate A Hi Alarm value should not exceed 99999(1869F h). If the value exceeds, the Rate A Hi Alarm will be replaced by the default value 00000.
40001	Rate A Hi Alarm Lo	LSB of the Rate A Hi Alarm. The Rate A Hi Alarm value should not exceed 99999(1869F h). If the value exceeds, the Rate A Hi Alarm will be replaced by the default value 00000.
40002	Rate A Lo Alarm Hi	MSB of the Rate A Lo Alarm. The Rate A Lo Alarm value should not exceed 99999(1869F h). If the value exceeds, the Rate A Lo Alarm will be replaced by the default value 00000.
40003	Rate A Lo Alarm Lo	LSB of the Rate A Lo Alarm. The Rate A Lo Alarm value should not exceed 99999(1869F h). If the value exceeds, the Rate A Lo Alarm will be replaced by the default value 00000.
40004	Rate B Hi Alarm Hi	MSB of the Rate B Hi Alarm. The Rate B Hi Alarm value should not exceed 99999(1869F h). If the value exceeds, the Rate B Hi Alarm will be replaced by the default value 00000.
40005	Rate B Hi Alarm Lo	LSB of the Rate B Hi Alarm. The Rate B Hi Alarm value should not exceed 99999(1869F h). If the value exceeds, the Rate B Hi Alarm will be replaced by the default value 00000.
40006	Rate B Lo Alarm Hi	MSB of the Rate B Lo Alarm. The Rate B Lo Alarm value should not exceed 99999(1869F h). If the value exceeds, the Rate B Lo Alarm will be replaced by the default value 00000.
40007	Rate B Lo Alarm Lo	LSB of the Rate B Lo Alarm. The Rate A Lo Alarm value should not exceed 99999(1869F h). If the value exceeds, the Rate B Lo Alarm will be replaced by the default value 00000.

40008	Draw Hi Alarm Hi	MSB of the Draw Hi Alarm. The Draw Hi Alarm value should not exceed 99999(1869Fh) or should not become less than -99999. If the value exceeds the limit, the Draw Hi Alarm will be replaced by the default value 00000.
40009	Draw Hi Alarm Lo	LSB of the Draw Hi Alarm. The Draw Hi Alarm value should not exceed 99999(1869Fh) should not become less than -99999. If the value exceeds the limit, Draw Hi Alarm will be replaced by the default value 00000.
40010	Draw Lo Alarm Hi	MSB of the Draw Lo Alarm. The Draw Lo Alarm value should not exceed 99999(1869Fh) should not become less than -99999. If the value exceeds the limit, Draw Lo Alarm will be replaced by the default value 00000.
40011	Draw Lo Alarm Lo	LSB of the Draw Lo Alarm. The Draw Lo Alarm value should not exceed 99999(1869Fh) should not become less than -99999. If the value exceeds the limit, If the value exceeds, the Draw Lo Alarm will be replaced by the default value 00000.
40012	Calibration Const A Hi	MSB of Numeric Constant for Rate A. The Calibration Const A value should not exceed 99999(1869F h). If the value exceeds, the Calibration Const A value will be replaced by the default value 00000.
40013	Calibration Const A Lo	LSB of Numeric Constant for Rate A. The Calibration Const A value should not exceed 99999(1869F h). If the value exceeds, the Calibration Const A value will be replaced by the default value 00000.
40014	Calibration Const B Hi	MSB of Numeric Constant for Rate B. The Calibration Const B value should not exceed 99999(1869F h). If the value exceeds, the Calibration Const B value will be replaced by the default value 00000.
40015	Calibration Const B Lo	LSB of Numeric Constant for Rate B. The Correction Const B value should not exceed 99999(1869F h). If the value exceeds, the Calibration Const B value will be replaced by the default value 00000.
40016	Draw Modes Hi	MSB of the Numeric value. Default value 0.
40017	Draw Modes Lo	LSB of the Numeric value used to select Draw mode as A-B (0), A/B (1), A-B/A (2), A-B/B (3). The Input mode value should not exceed 3. If the value exceeds, it will be loaded with A-B (0).
40018	Output Hi	MSB of the Numeric value. Default value 0.
40019	Output Lo	LSB of the Numeric value used to select Solid state output mode as Follows (0), Pulsed (1) or Latched (2). The output mode value should not exceed 2. If the value exceeds, it will be loaded with Follows (0).

40020	Baud _Select Hi	MSB of the Numeric value. Default value 0.
40021	Baud _Select Lo	LSB of the Numeric value used to select the Baud rate for Serial communication. The value can not exceed 3. If the value exceeds, the default value 0 is loaded which terminates the communication.
40022	Serial _ID Hi	MSB of the Numeric value. Default value 0.
40023	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.
40024	Decimal Point position for Rate A Hi	MSB of the Numeric value. Default value 0.
40025	Decimal Point position for Rate A Lo	LSB of the Numeric value used to assign Decimal Point position for Rate A. The value should not exceed 4 and should not be less than 0. If the value exceeds, the value of Decimal Point position will be replaced by 0.
40026	Decimal Point position for Rate B Hi	MSB of the Numeric value. Default value 0.
40027	Decimal Point position for Rate B Lo	LSB of the Numeric value used to assign Decimal Point position for Rate B. The value should not exceed 4 and should not be less than 0. If the value exceeds, the value of Decimal Point position will be replaced by 0.
40028	Decimal Point position for Draw Hi	MSB of the Numeric value. Default value 0.
40029	Decimal Point position for Draw Lo	LSB of the Numeric value used to assign Decimal Point position for Draw. The value should not exceed 4 and should not become less than 0. If the value exceeds, the value of Decimal Point position will be replaced by 0.
40030	Decimal Point position for Calibration Constant A Hi	MSB of the Numeric value. Default value 0.
40031	Decimal Point position for Calibration Constant A Lo	LSB of the Numeric value used to assign Decimal Point position for Calibration Const A. The value should not exceed 4 and should not become less than 2. If the value exceeds the limit, the value of Decimal Point position will be replaced by 4.
40032	Decimal Point position for Calibration Constant B Hi	MSB of the Numeric value. Default value 0.
40033	Decimal Point position for Calibration Constant B Lo	LSB of the Numeric value used to assign Decimal Point position for Calibration Const B. The value should not exceed 4 and should not become less than 2. If the value exceeds the limit, the value of Decimal Point position will be replaced by 4.

ORDERING INFORMATION ...



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.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

SERVICE

If this product requires service, call Eagle Signal for an RMA (Return Material Authorization) number, pack it in a sturdy carton and ship prepaid to: Service Dept. at address below.

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

Eagle Signal Controls 2100 W Broad St. P.O. Box 368, Elizabethtown, NC 28337
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