FACTORY VISION
ELECTRO-MATIC VISUAL

Clock/Four Digit Numeric Display User Manual
Version 1.2

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Revision History

Date	Revision	Description of Change	Initials
04-22-16	1.0	Original Version	JT
11-25-19	1.1	Removed PoE, Updated Pictures, Updated Alarm Output Function and Wiring section, Added Appendix D, E & F	JT
12-03-19	1.2	Input Voltage Range Updated	JT

Standard Features and Functions

- Clock and / or 4 Digit Numeric Display with UP/Down Timer or Counter Capabilities
- Ethernet Interface and optional M-12 D-Coded Connector
- Dry contact input for up/down counting/timing increment and decrement
- Capable of displaying up to four digit numbers sent using ASCII commands
- Capable of storing up to 10 preset values for timer/counter functions
- Capable of changing Preset values using ASCII Commands
- Capable of resetting to the Preset value using ASCII Commands
- Alarm output with up to 10 available set points
- Automatic Daylight Saving Time adjustment
- Compact and lightweight
- Mounting Hardware included for easy installation
- Display is built using ultra-bright Red LEDs
- Long life. 100,000 Hours Estimated LED Life
- Low power consumption. Draws only 15 Watts
- Four inch numbers
- Rugged aluminum body
- Side access buttons for time or count increment/decrement
- Networkable over Ethernet or Serial (RS485)
- Time zone offset features
- Readable from 200+ feet
- Power backup for maintaining accurate time during short power outages
- 12/24 hour selectable Clock Display
- 2 level brightness adjustment
- Multi-clock network connection. Synchronous time zone displaying.

Technical Specifications

Power input:	100-240VAC 50/60Hz to 12VDC Power Adapter Included Optional receptacle and mating cable for 24VDC (16 - 30VDC) input
Power consumption:	15W
Operating Temperature:	-20°C to 70°C
Operating Humidity:	0 to 95% Noncondensing
Dimensions:	13.1”(333mm)(L)×6.2”(158mm)(H)×2”(50mm) (D)
Approx. Weight:	1.1 lbs (0.5KG)
Numeral Height:	4” (10 cm)
Communications:	Ethernet and Serial (RS485) Optional D-Coded M-12 receptacle for Ethernet
Time format:	12 hour or 24 hour switch selectable
Time Accuracy:	Within -1 second every 24 hours

1. Clock Display Functionality and Operating Modes

1.1. Functions and features

- 12/24 hour clock selectable
- 2 level brightness adjustment
- Multi-clock network connection. Synchronous time zone displaying.
- Time zone setting
- Auto Daylight Saving Time adjustment
- Remote or Local Time adjustment

1.2. Operation Instructions

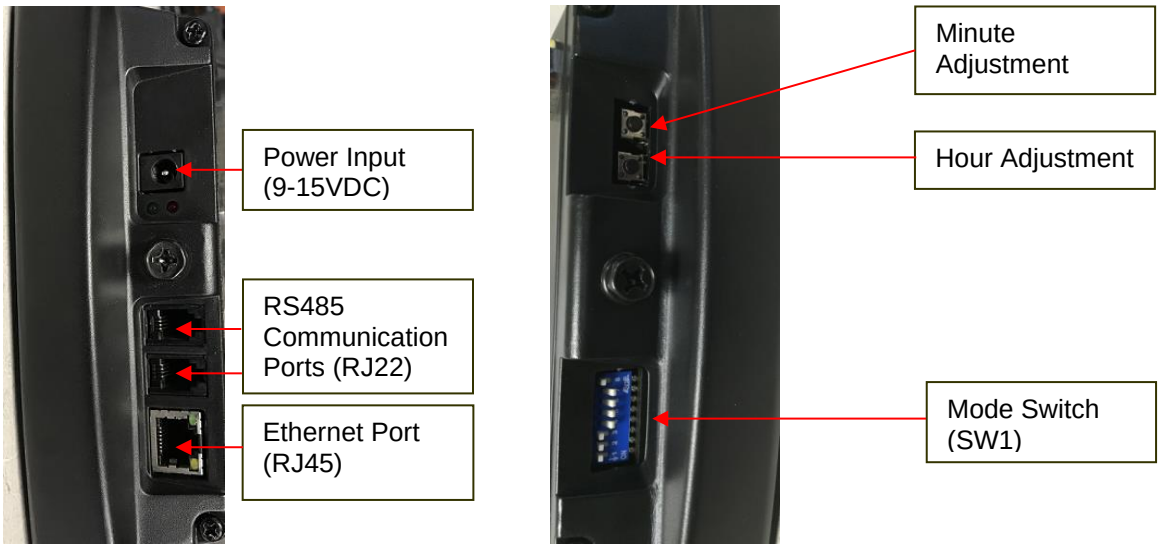


FIGURE 1

1.2.1. Power Input

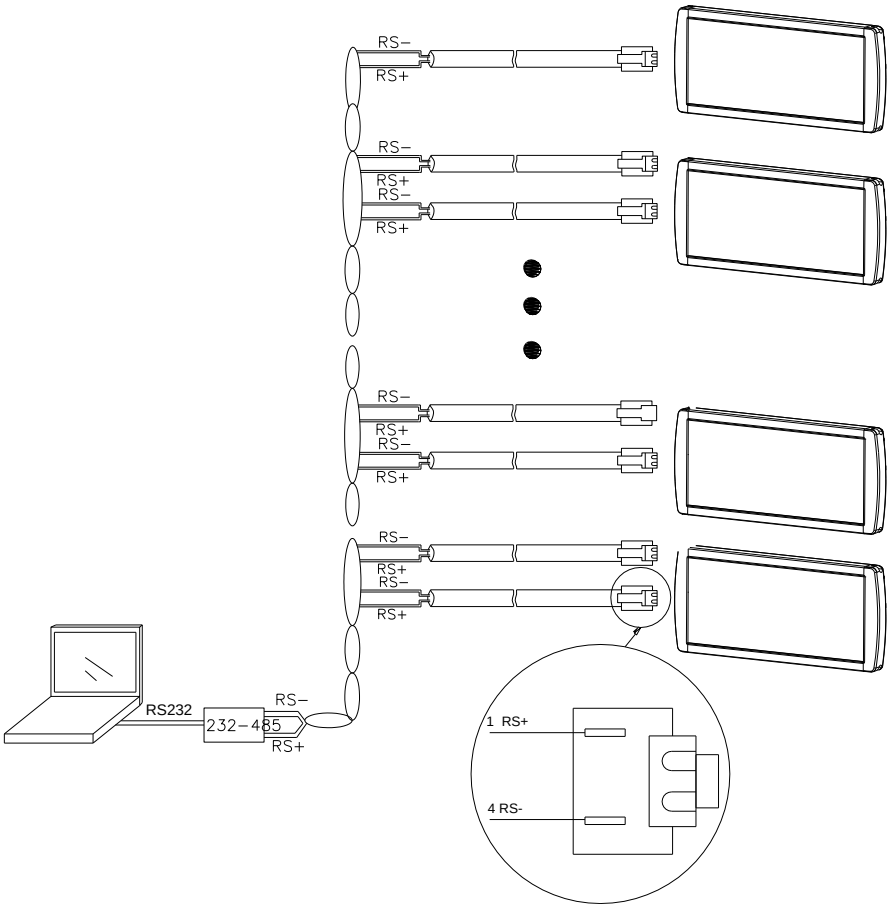
Power input is through a 100-240VAC 50/60Hz to 12VDC (9-15VDC) Power Adapter. Optional receptacles and mating cables available for 24VDC (16 - 30VDC) input. Refer to Appendix for available options.

1.2.2. Ethernet Connection

The Ethernet port utilizes a standard RJ45 jack. An optional D-Coded M-12 receptacle can be added for Ethernet. Refer to Appendix for the D-Coded M-12 receptacle pin out. The default IP address for the Ethernet Port is 169.254.10.49 and IP port is 3001.

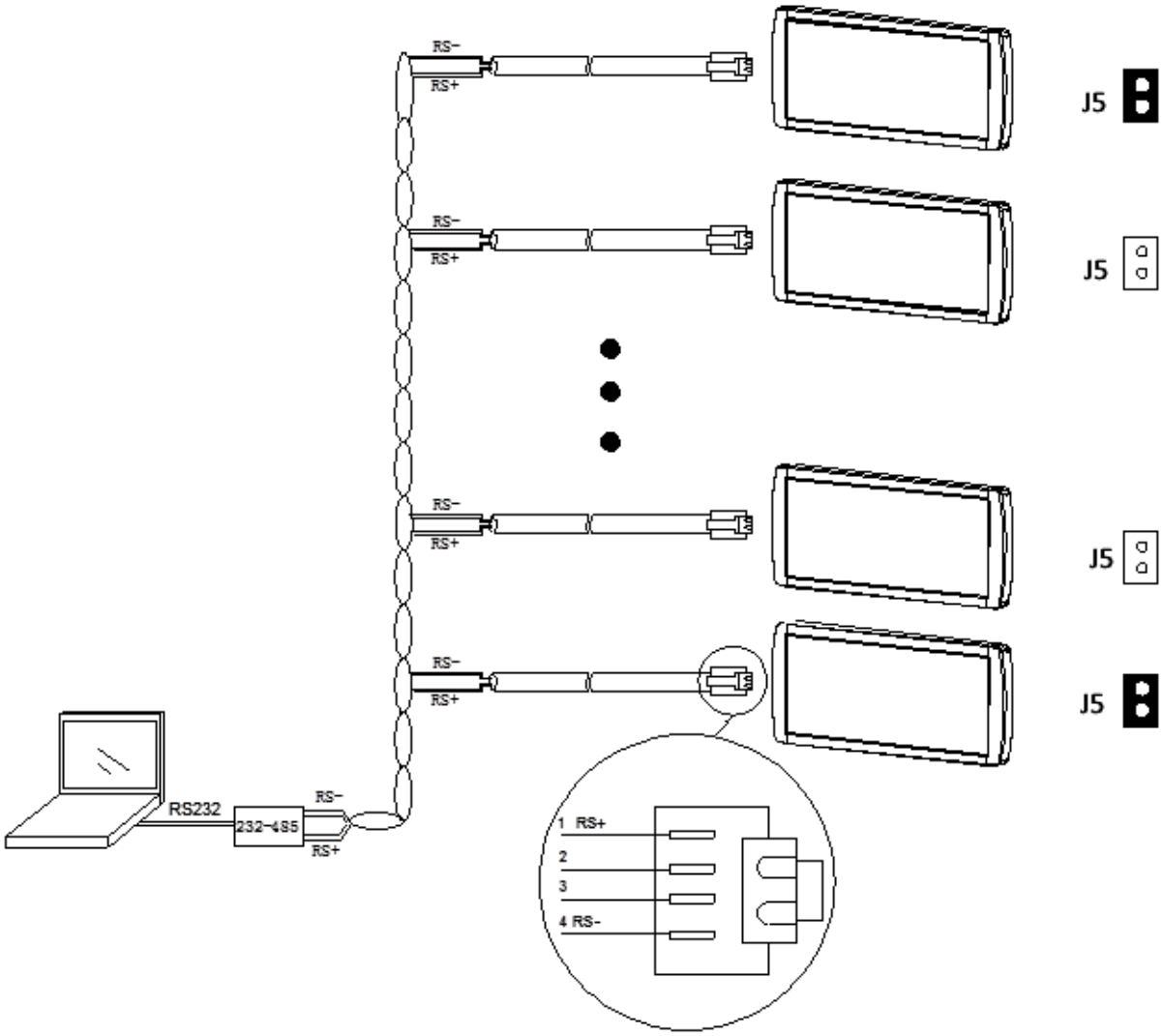
1.2.3. RS485 Connection Diagram

The RS485 port utilizes an RJ22 jack. The pin outs for the two RS485 sockets are identical. Below are the connection details.



1.2.4. RS485 Network Termination Resistor (J5)

The display units are fitted with RS485 network termination resistor that can be used as an option. The first and the last sign in the network require this termination. J5 on the inside of the display is used for this. Refer to Figure 3 in Section 5 to find the location of J5 on the main board. Install a jumper between the two pins of J5 to include the termination resistor and remove the jumper to eliminate termination resistor. The following diagram illustrates the use of termination.



1.2.5. Time adjustment Buttons

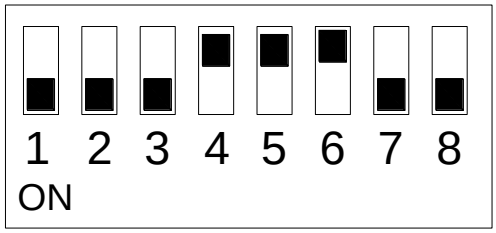
Button for adjusting minutes (Button towards the top of the display): One minute is added every time the button is pressed. Pressing the button will change the minute display between the numbers 0 to 59. If the button is held, the display will increment rapidly to facilitate quicker changes. The unit will emit a beeping sound each time the button is released.

Button for adjusting hours (Lower Button): One hour is added every time the button is pressed. Pressing the button will change the hour display between the numbers 1 to 12 if the clock is set as a 12 hour display, while it ranges from 0 to 23 if the clock is set as a 24 hour display. If the button is held, the display will increment rapidly to facilitate quicker changes. The unit will emit a beeping sound each time the button is released.

1.2.6. AM/PM setting

There is a colon between the hour and minute display. This colon will be flashing at a one second interval during normal clock operation. When the clock is set for 12 hour display mode and the time is changed utilizing the minute or hour pushbutton, the upper dot will stay lit, when the time displayed is AM and the lower dot will stay lit when the time displayed is PM.

1.2.7. Mode Switch (SW1) Settings



SW1 Switch Number	Value if ON	Value if OFF
1	Minus	Plus
2	8 Hr.	0
3	4 Hr.	0
4	2 Hr. or 0.1 Sec Reset and timing to negative in Timer Mode	0
5	1 Hr. or mm:ss for Timer Mode	0 or hh:mm for Timer Mode
6	**Numeric Display**	**Clock Display**
7	**24 Hr. Time Mode or Up/Down Timer Mode**	**12 Hr. Time Mode or Up/Down Counter Mode**
8	**High Brightness (100%)**	**Normal Brightness (40%)**

Table 1

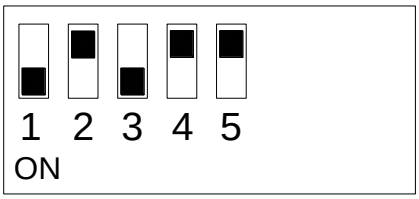
Refer to the table above for the SW1 Mode dip switch settings. ON is set by placing the dip switch towards the front face. The definition of each dip switches are described in detail below:

1.2.7.1. Dip switch No 1 to 5

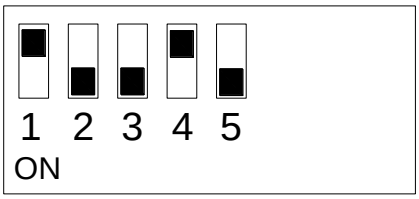
Dip switch No 1 to 5 are used to set the time zone, using “hour” as its unit of measure. Whatever time is currently displayed, or sent to the clock via the RS485/Ethernet port, will be offset for time zone based on the setting of these 5 dip switches. If the clock will be a standalone unit or the time zone feature is not required then it is recommended to leave Dip Switch numbers 1 to 5 OFF.

Dip switch Number 1 represents “Addition” or “Deduction” of the time zone which is chosen by the addition of dip switches 2 to 5 in Binary with dip switch #5 being the least significant digit. ON means “addition” while “0” refers to “deduction”

For example:



The value of dip switch as shown in the picture above is “10100”, which is equal to GMT-04:00. This will subtract 4 hours from the current time displayed or what is sent to the display via the RS485 RS485/Ethernet port Ethernet port.



The value of dip switch as shown in the picture above is “01101”, which is equal to GMT+13:00. This will add 13 hours to the current time displayed or what time is sent to the display via the RS485/Ethernet port.

1.2.7.2. Dip switch No 4

Dip switch No 4 has an alternate function other than time zone when dip switch No. 6 & 7 are set to ON. When dip switch No. 6 & 7 are set to ON, the display functions as an up/down timer, and dip switch No.4 set to ON allows for a 0.1 second (100ms) reset time and enables timing down to negative.

1.2.7.3. Dip switch No 5

Dip switch No 5 also has an alternate function other than time zone when dip switch No. 6 & 7 are set to ON. When dip switch No. 6 & 7 are set to ON, the display functions as an up/down timer, and dip switch No.5 sets the display format to show HOURS:MINUTES if set to OFF and MINUTES:SECONDS if set to ON.

1.2.7.4. Dip switch No 6

Dip switch No 6 is used to select if the display will function as a “Time” display or a “4 Digit Numeric” Display. When the switch is set to ON the display functions as a “4 Digit Numeric Display”, when it is set to OFF the display functions as a “Time display”. The Time display setting allows the display to operate as a CLOCK, displaying hours and Minutes.

The 4 Digit Numeric Display setting allows the unit to receive up to 4 digit numbers (0 to 9999) via the RS485/Ethernet port in ASCII format and display them. It can also display a colon between 2nd and 3rd numbers and a negative sign. Also, the display can function as an UP/DOWN COUNTER or UP/DOWN TIMER and start counting/timing from the value it

is displaying when the push buttons on the side is pressed or a customer supplied dry contact on terminals Key1 or Key 2 is activated.

1.2.7.5. Dip switch No 7

Dip switch No 7 serves a dual function and is used to select the 12/24 hour option when dip switch No. 6 is OFF and when dip switch No. 6 is ON then it is used to select if the unit will function as an UP/DOWN TIMER or UP/DOWN COUNTER.

When dip switch No. 6 is OFF and dip switch No. 7 is ON sets the clock to operate in the “24 hour mode”(military time); OFF sets the clock to operate in the “12 hour mode”(time from 12:00 to 11:59).

When dip switch No. 6 is ON and dip switch No. 7 is ON the display functions as an UP/DOWN TIMER. When dip switch No. 6 is ON and dip switch No. 7 is OFF the display functions as an UP/DOWN Counter.

1.2.7.6. Dip switch No 8

Dip switch No 8 is used to set the display brightness. When it is ON, the unit will show “High brightness” or 100% brightness, while OFF will show “Standard brightness” or 40% of High brightness. This allows the user to adapt the brightness to the surrounding environment. In a highly lit setting, the “High brightness” setting would be appropriate. Conversely in a dimly lit setting, the “Standard brightness” setting would be appropriate.

1.3. Example of a Synchronized Clock Network

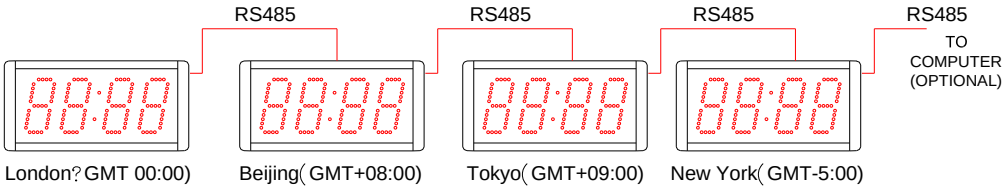
With a simple connection and installation, you can have several clocks displaying the local time of other places synchronically.

Address setting: You should first choose a main clock. Its address must be set as 63 using SW2. Others are set as slave clocks and their addresses can be set to any other address except 63.

Time zone setting: Time zone determines the deviation of time from Greenwich Mean Time (GMT). You can set the time zone on the display utilizing the SW1 dip switch No 1 to 5 as shown in Section 1.2.7.1. For example, to display New York Time, the Time Zone Dip Switch should be set for “GMT-05:00”

RS485 network: Connect the RS485 network between each display utilizing RJ22 connectors and daisy chain the displays. The order of the clocks will not matter in the connection scheme. Refer to the connection diagram in Section 1.2.3 if unsure about the RS485 connection scheme.

The slave-clocks will adjust their time automatically according to the main clock time and their individual time zone.
Here is an example.
Assume that there are several clocks in the hall of a hotel.



1)The New York clock is set as the main clock by changing the communication address setting to 63; the remaining clocks are set with different addresses, but not 63.
2)All the clocks are set with different time zones, as shown in the above picture.
3)The clocks are connected using the RS485 network.
4)The clocks will start displaying the time once the power is turned on.
5)When the time on the main clock is adjusted, the slave clocks will get adjusted automatically. For example, when the main clock (New York) is adjusted to 5:00, the time in London, Beijing and Tokyo clocks will get adjusted to 12:00, 8:00 and 9:00 respectively.

1.4. Daylight Saving Time Feature

Daylight Saving Time function requires the below settings to be set on the clock.

Day of the Week must be set on the display

Day of the week must be set by sending the below command structure via RS485/Ethernet to the display.
<0x01>Zaa<0x02>E&X<0x04>, where aa is the ASCII address of the clock display in HEX (00 can be used to set all clocks) and X is a number that corresponds to the day of the week (1 = Sunday, 2 = Monday, 3 = Tuesday, 4 = Wednesday, 5 = Thursday, 6 = Friday, 7 = Saturday).
Example: <0x01>Z00<0x02>E&5<0x04> Sets the day of the week to Thursday for all clocks on the serial network.

Date with Month, Day and Year must be set on the display

Date must be set by sending the below command structure via RS485/Ethernet to the display.
<0x01>Zaa<0x02>E;MMDDYY<0x04>, where aa is the ASCII address of the clock display in HEX (00 can be used to set all clocks).
MM is two digits for the month (01 = January, 02 = February.... 12 = December).
DD is two digits for the day of the month (01 - 31).

YY is two digits that correspond to the year (05 = 2005, 99 = 2099).
Example: <0x01>Z00<0x02>E;040816<0x04> Sets the date to April 8, 2016 for all clocks on the serial network.

Set the SW2 Switch for Daylight Saving Time

The 2nd switch on SW2, labeled 2, is for the **Daylight Saving Time** option. When the display is in the clock mode (SW1, 6th switch set to OFF), and the SW2 2nd switch is set to ON, Daylight Saving Time is enabled on the Clock. The clock will automatically adjust the time forward one hour during the daylight saving time period which starts on the second Sunday in March and ends on the first Sunday in November and conversely set the time back one hour during the other period of time. Setting the 2nd switch OFF will disable **Daylight Saving Time.** See Section 5.2 for more information on this.

1.5. Updating the Clock Time with ASCII command

The SW1 Dip Switch must have switch No. 6 set to OFF for these commands to function.

The clock will maintain and display the current time. The command that follows is used for initial clock settings and syncing to other clocks within the network.

The following command line sets the time of the clock in 24-hour format. The clock module has an address of 00 in this example but can be set to any Address except 63. Address 63 makes the clock to be a master clock and it will echo commands on the RS485 network on power up to control other clocks on the same network. This can interfere with other RS485 signals so care must be used when setting a clock to address 63 if devices other than clocks are also connected to the same RS485 network.

Command: <0x01>Z00<0x02>E HHMMSS<0x04>

Where:

<0x01> = “Start of Header” ASCII character. (Hex 01)
“Z” = ASCII place holder character. (Can be any ASCII character)
“00” = Sign address. (“00” as a sign address broadcasts to all the signs in the network)
<0x02> = “Start of Text” ASCII character (Hex 02) always precedes the Command Code.
“E ” = Write to clock display (NOTE: The E is followed by a space)
“HHMMSS” = Hours (24 hr. format) Minutes and Seconds. No colon is required but will be displayed between the hours and minutes on the clock. The “SS” is optional and if not sent, the seconds will be zeroed.
<0x04> = “End of Transmission” ASCII character (Hex 04).

1.6. Command to Recall Clock Settings

The command is used to get back the time and stored settings from the clock display.

Command: <0x01>Z##<0x02>ET<0x04>
Command Reply: <0x01>Z##<0x02>ERYYMODAWKHHMMSS<0x04>
Where:
ER = Read from clock display
YY = Year
MO = Month
DA = Date
WK = Day of the week
HH = Hour
MM = Minute
SS = Seconds

NOTE: Care must be taken with this command in that only one clock unit can be on the RS485 network if and when this command is issued on the network. Otherwise the other clock units will all interfere with each other trying to send the reply at the same time.

2. Four Digit Numeric Display Functionality

2.1. Functions and Features

- Serial and Ethernet interface
- Push buttons for manually incrementing or decrementing the displayed value
- Dry contact inputs to Key1 and Key2 for incrementing or decrementing the displayed value
- Range of serial address setting:0~63 (00 is the address for broadcast)
- RS485 and Ethernet Networkable
- Up/Down Timing
- Up/Down Counting
- Alarm output
- Simple four digit numeric display that can show the value sent to it via RS485/Ethernet

2.2. Operation Instructions

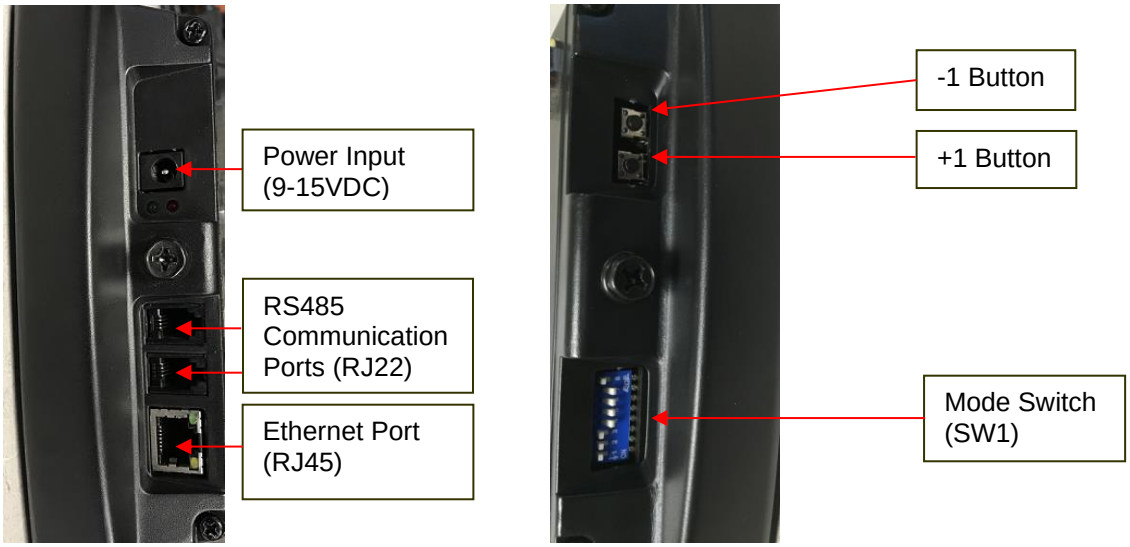
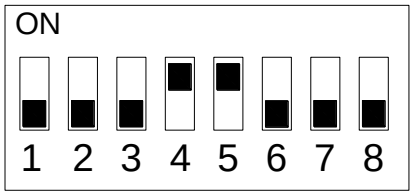


FIGURE 2

2.2.1. Power and Data Ports

Please refer back to Section 1.2 for information on the RS485, Ethernet Communication ports and the DC input interface.

2.2.2. Mode Switch (SW1) Settings



Only SW1 Dip switches labeled 4, 5, 6, 7 and 8 are used when the display is used as a 4 Digit Numeric Display. Switch No. 6 and No. 7 sets the 4 Digit Numeric Display Mode and Switch No. 8 sets the High Brightness mode. Switch No. 5 sets the timer display for hours or minutes when switch 7 is ON. Switch No. 4 set to ON allow for a 0.1 second (100ms) reset time and enables timing down to negative when switch 6 & 7 is ON. The switch settings are described in detail in Section 1.2.7.

2.2.3. Increment/Decrement Buttons

The increment and decrement buttons or Key1 and Key2 inputs allows the changing of the displayed number. Allowed ranges are from -999 to 9999 when in counter mode (SW1 switch No.6 = ON switch No.7 = OFF); 0:00 to 99:59 when in timer mode for hours:minutes (SW1 switch No.6 = ON switch No.7 = ON and switch No.5 = OFF); 0:00 to 59:59 when in timer mode for minutes:seconds (SW1 switch No.6 = ON switch No.7 = ON and switch No.5 = ON). Key1 input is for increment and Key2 input is for decrement.

2.2.4. Counter Mode

In Counter Mode each push of the Button or input closure (increment or decrement) will change the displayed value by one. As an example; if the display was showing a value of 346 and the increment button is pressed then the display would show 347. Conversely, if the display was showing a value of 346 and the decrement button is pressed then the display would show 345.

In counter mode, the display will only count up to 9999 and down to –999. The display needs to be reset by pressing the +1 and –1 buttons at the same time for 3 seconds to go back to the Set Point value to start counting again. On reset, the display will show the Set Point value stored using the S01 command or zero if no Set Point value is stored. Example of the use of an up/down counter is discussed in Section 2.2.6.2.

NOTE: In Counter Mode the Display will not add/subtract continually when you hold down the respective buttons. The increment/decrement will only occur on each push and release of the respective buttons.

2.2.5. Timer Mode

In Timer Mode each push and hold of the Button or input closure (increment or decrement) will change the displayed value by one time value (If SW1 switch No.5 = ON then each increment is in seconds on the display or if SW1 switch No.5 = OFF then each increment is in Minutes on the display) and continue timing until the button or input is released.

As an example if the display showed a value of 00:25, SW1 Dip No. 5 = ON, and the increment button or input KEY1 was pressed and held then the display would now show 00:26 after 1 second and continue to increment until the button or input is released. So if the button was held for 10 seconds the display would show 00:35. Conversely, if the display showed a value of 00:35 and the decrement button or input KEY2 was pressed and held for 5 seconds then the display would show 00:30.

If SW1 Dip No. 5 = OFF, then the display will show hours and minutes. If the display showed a value of 00:25 and the increment button or input KEY1 was pressed and held then the display would show 00:26 after 1 Minute and continue to increment until the button or input is released. So if the button was held for 10 minutes the display would show 00:35. Conversely, if the display showed a value of 00:35 and the decrement button or input KEY2 was pressed and held for 5 minutes then the display would now show 00:30. The display does keep track of the seconds as well but does not display the seconds value when SW1 Dip No. 5 is OFF.

If both the +1 button or Key1 and the –1 button or Key2 are held closed for 3 seconds (0.1 Seconds if SW1 switch no 4 is ON), then the time will be reset to a Set Point value stored in the display**.** If a Set Point Value Storage Command (S01) has not been issued via the RS485/Ethernet port, then the value will be zero**.**

In timer mode for hours:minutes (Dip Switch 6 and 7 ON and 5 OFF), the clock will only go up to 99:59 and down to 0:00. The clock needs to be reset by pressing the +1 and –1 buttons at the same time for 3 seconds to go back to the Set Point value stored using the S01 command. If no Set Point value is stored, the clock will display 00:00.

In timer mode for minutes:seconds (Dip Switch 6 and 7 ON and 5 ON) with SW1 Dip switch 4 OFF when the increment (+1) button is held down, the clock will display 00:00 after 59:59. Likewise, when the decrement (-1) button is held down, the clock will display 59:59 after 00:00.

In timer mode for minutes:seconds with SW1 Dip switch 4 ON, when the decrement (-1) button is held down, the clock will countdown to negative (–0:01, -0:02…etc.) after 0:00. Example of the use of an up/down timer is discussed in Section 2.2.6.1 .

2.2.6. Set Point Storage Command for the Increment/Decrement Function (SXX)

The command is used to update the preset values stored in the set points in the nonvolatile memory of the display. 10 set points are available on the display that can be updated using the Set Point Storage command (SXX), which can then be selected using the Set Point selection command (PXX). The default Set Point is 01 and is updated with S01 command. The Set Point values will default to zero if no command is issued to the display to update them. Set Point values can be updated via the RS485/Ethernet port.

Command: <0x01>Zaa<0x02>SXXhhmm<0x04>

Where:
<0x01> is the start of header

aa is the ASCII address of the sign in hexadecimal value 0-3F to represent 0-63 decimal. Refer to Appendix B for conversion to hex.

<0x02> is the start of text

SXX is the command for updating the Set Point, where XX can range from 01 to 10 for set points 01 through 10. The Set Points are stored in the flash memory of the display and can only be changed by another SXX command. Note that 2 digits **must** be sent for the set point value.

hhmm is the value to be stored as a preset and its interpretation will depend on the SW1 dip switch settings. The data will be interpreted as the following:

If SW1 switch No.6 = ON switch No.7 = OFF, then hhmm = numeric preset value ranging from -999 to 9999 in value

If SW1 switch No.6 = ON switch No.7 = ON switch No.5 = OFF, then hhmm = timer preset value where hh = hours (0 to 99) and mm = minutes (0 to 59)

If SW1 switch No.6 = ON switch No.7 = ON switch No.5 = ON, then hhmm = timer preset value where hh = minutes (0 to 99) and mm = seconds (0 to 59)

NOTE: The length of the data does not need to be four digits long. For example, 0012 for 12 minutes can also be input as 12.

<0x04> End of Transmission

CAUTION: This stores the value in nonvolatile memory with a maximum of 1 Million writes.

2.2.6.1. Example of the use of an up/down timer

Step 1: Place the SW1 Dip switch #6 and # 7 in the ON position and #5 in the OFF position.

Result: The display will now be placed in the up/down timer mode for hours:minutes.

Step 2: Send the following command to the display <0X01>Z01<0X02>S010<0X04>

Result: The value of 0 hours and 0 minutes is stored for Set Point 01 in nonvolatile memory of the display with address of 01.

Step 3: Press the +1 and -1 buttons at the same time (or connect the terminals GND, KEY1, KEY2) and maintain for 3 seconds or more, then release both buttons.

Result: The display will show a value of 0:00 which is the value stored in Set Point 01.

Step 4: Press the +1 button and hold for 3 minutes then release.

Result: The unit will add time to the display every minute and for this example, the unit will display 0:01 then 0:02 then 0:03.

Step 5: Press the -1 button and hold for 1 minute then release.

Result: The unit will subtract time from the display every minute and for this example, the unit will display 0:02.

Step 6: Send the following command to the display <0X01>Z00<0X02>S01147<0X04>

Result: The value of 1 hours and 47 minutes is stored for Set Point 01 in nonvolatile memory of the display with any address.

Step 7: Press the +1 and -1 buttons at the same time (or connect the terminals GND, KEY1, KEY2) and maintain for 3 seconds or more, then release both buttons.

Result: The display will show a value of 1:47 which is the value stored in Set Point 01.

Step 8: Press the +1 button and hold for 3 minutes then release.

Result: The unit will add time to the display every minute and for this example, the unit will display 1:48 then 1:49 then 1:50.

Step 9: Press the -1 button and hold for 1 minute then release.

Result: The unit will subtract time from the display every minute and for this example, the unit will display 1:49.

2.2.6.2. Example of the use of an up/down counter

Step 1: Place the SW1 Dip switch #6 in the ON position and #7 in The OFF position.

Result: The display will now be placed in the up/down counter mode.

Step 2: Send the following command to the display <0X01>Z01<0X02>S010<0X04>

Result: The value 0 is stored for Set Point 01 in nonvolatile memory of the display with address of 01.

Step 3: Press the +1 and -1 buttons at the same time (or connect the terminals GND, KEY1, KEY2) and maintain for 3 seconds or more, then release both buttons.

Result: The display will show a value of 0 which is the value stored in Set Point 01.

Step 4: Press and release the +1 button 3 times.

Result: The unit will count up for each press and release and for this example; the unit will display 1 then 2 then 3.

Step 5: Press and release the -1 button.

Result: The unit will count down for each press and release and for this example; the unit will display 2.

Step 6: Send the following command to the display <0X01>Z00<0X02>S01147<0X04>

Result: The value of 147 is stored for Set Point 01 in nonvolatile memory of the display with any address.

Step 7: Press the +1 and -1 buttons at the same time (or connect the terminals GND, KEY1, KEY2) and maintain for 3 seconds or more, then release both buttons.

Result: The display will show a value of 147 which is the value stored in Set Point 01

Step 8: Press and release the +1 button 3 times.

Result: The unit will count up for each press and release and for this example; the unit will display 148 then 149 then 150.

Step 9: Press and release the -1 button.

Result: The unit will count down for each press and release and for this example; the unit will display 149.

2.2.7. Set Point Selection Command for the Increment/Decrement Function (PXX)

The command is used to select the set points stored in the nonvolatile memory of the display. 10 set points are available on the display that can be updated using the Set Point Storage command (SXX), which can then be selected using the Set Point selection command (PXX). The default Set Point is 01. Set Points can be selected via the RS485/Ethernet port.

Command: <0x01>Zaa<0x02>PXX<0x04>

Where:
<0x01> is the start of header

aa is the ASCII address of the sign in hexadecimal value 0-3F to represent 0-63 decimal. Refer to Appendix B for conversion to hex.

<0x02> is the start of text

PXX is the command for selecting the Set Point, where XX can range from 01 to 10 for set points 01 through 10. The command will change the default set point to be the selected set point. 2 digits **must** be sent for the set point value.

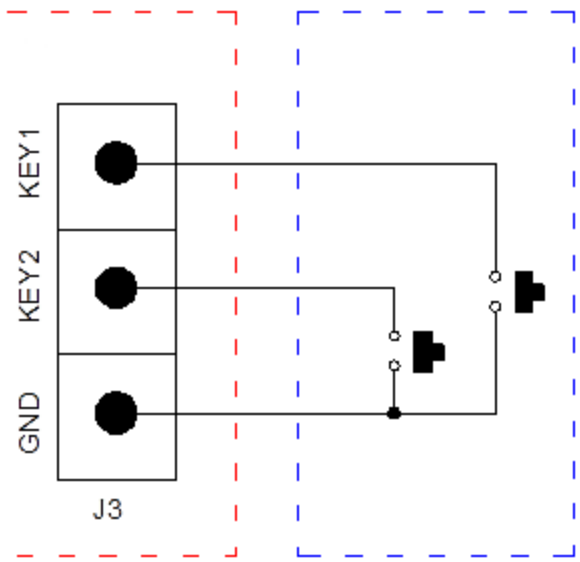
Note: The default set point will revert back to 01 if power to the display is reset.

<0x04> End of Transmission

2.2.8. Increment/Decrement Dry Contact Input Wiring

KEY1 (increment) & KEY2 (decrement) are two dry contact inputs internal to the display. Refer to Figure 3 in Section 5 for their location. The Inputs for the increment and decrement functions are in parallel to the buttons on the display and need to be dry contacts (unpowered). The display can be purchased with an optional 6 pin receptacle to simplify this hookup. The connections are shown below.

KEY1 is Increment
KEY2 is Decrement



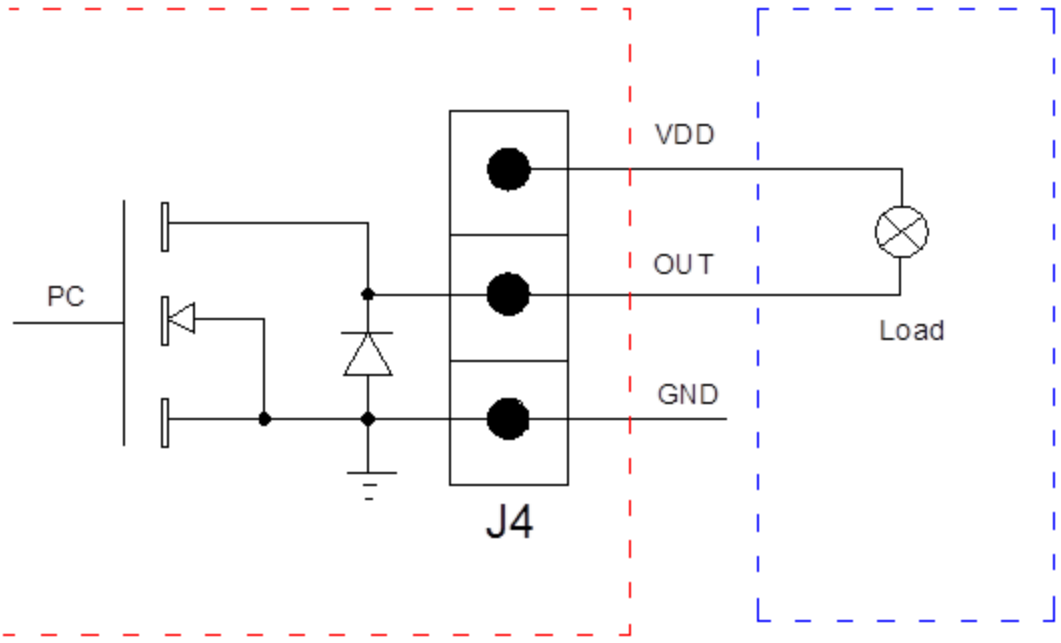
2.2.9. Alarm Output Function and Wiring

When the numerical value of the timer or counter is equal to a Set Point warning value, it will output the warning signal. When SW1 #4 is off, the warning will stop when the value is no longer equal to a Set Point value. With SW1 #4 on, the warning will remain on when the value is equal to or less than the Set Point value.

When the Alarm Connector on the display "J4" is connecting to a load, its maximum current draw cannot exceed 0.5 Amps. The Alarm output can be connected in two ways as shown in the schematic below. First method uses the internal power source and the second uses an external power source.

2.2.9.1. Alarm Output with Internal Power Source

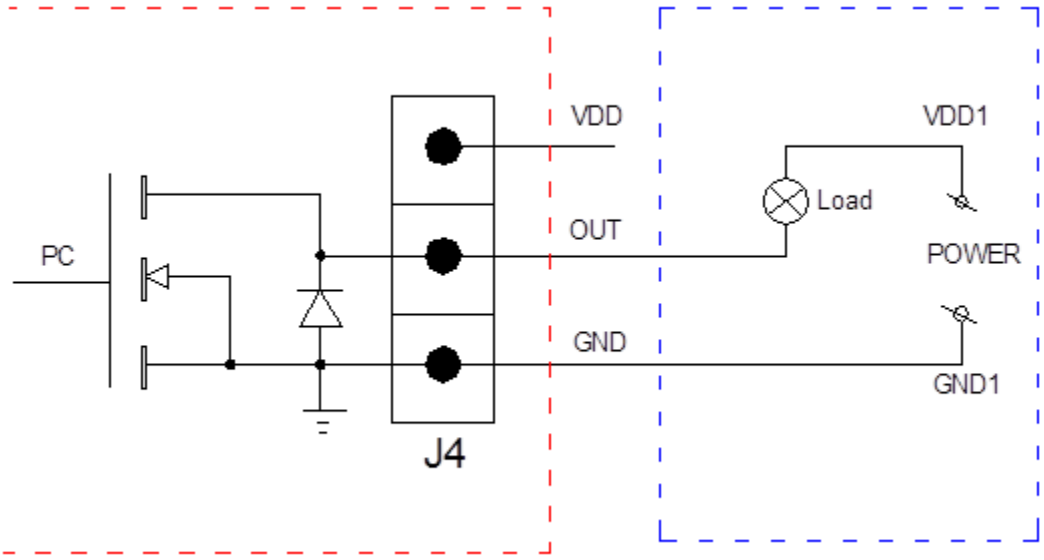
When using the internal power source of the display, the connections should be as shown in the schematic below. The voltage supplied to the load will be limited to 12VDC when the internal power source is used.



Schematic for Alarm Output with Internal Power Source

2.2.9.2. Alarm Output with External Power Source

When the Alarm load and the Display are using different power supplies, the connections should be as shown in the schematic below. The voltage range for the external power source must be between 16-30VDC and the load must not draw more than 0.5 Amps.



Schematic for Alarm Output with External Power Source

2.2.10. Set Point Storage Command for Alarm Output (SXX)

The command is used to update the preset alarm values stored in the set points in the nonvolatile memory of the display. 10 set points are available on the display for alarm values that can be updated using the Set Point Storage command (SXX). The Set Point alarm values will default to zero if no command is issued to the display to update them. Set Point alarm values can be updated via the RS485/Ethernet port.

Command: <0x01>Zaa<0x02>SXXhhmm<0x04>

Where:
<0x01> is the start of header

aa is the ASCII address of the sign in hexadecimal value 0-3F to represent 0-63 decimal. Refer to Appendix B for conversion to hex.

<0x02> is the start of text

SXX is the command for storing the Set Point, where XX can range from 11 to 20 for set points 11 through 20. The values will be stored in the flash memory of the display and can only be changed by another SXX command. Note that 2 digits **must** be sent for the set point value.

hhmm is the value to be stored as a preset and its interpretation will depend on the SW1 dip switch settings. The data will be interpreted as the following:

If SW1 switch No.6 = ON switch No.7 = OFF, then hhmm = numeric preset value ranging from -999 to 9999 in value

If SW1 switch No.6 = ON switch No.7 = ON switch No.5 = OFF, then hhmm = timer preset value where hh = hours (0 to 99) and mm = minutes (0 to 59)

If SW1 switch No.6 = ON switch No.7 = ON switch No.5 = ON, then hhmm = timer preset value where hh = minutes (0 to 99) and mm = seconds (0 to 59)

NOTE: The length of the data does not need to be four digits long. For example, 0012 for 12 minutes can also be input as 12.

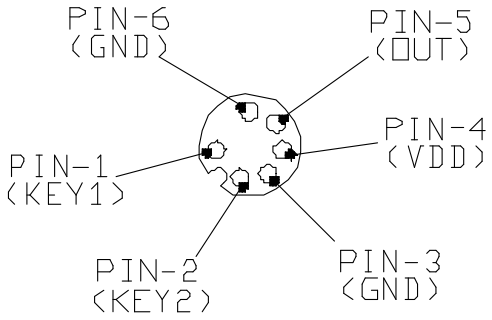
<0x04> End of Transmission

CAUTION: This stores the value in nonvolatile memory with a maximum of 1 Million writes.

2.2.11. Optional 6 Pin Receptacle and Mating Cable

The display can be purchased with an optional 6 pin receptacle to simplify the hookup of the input (increment/decrement) and alarm terminals. With this connector in place, the display no longer needs to be opened to access the internal terminals. The pin out for the receptacle is shown below.

RECEPTACLE FUNCTION
PIN-1: KEY1 FUNCTION
PIN-2: KEY2 FUNCTION
PIN-3: GROUND
PIN-4: INTERNAL OUTPUT POWER OR + INPUT POWER 9-30VDC
PIN-5: OUTPUT
PIN-6: EXTERNAL OUTPUT GROUND OR - INPUT POWER 9-30VDC



Please check with your sales representative to order this option.

2.2.11.1. External DC power for the display through 6 Pin Receptacle

It is also possible to utilize the receptacle to bring external DC power to the display. Connect Plus 16-30 VDC to Pin 4 and minus 16-30 VDC to pin 6 to power the display externally. When this is done then the output can go between Pin 4 & 5.

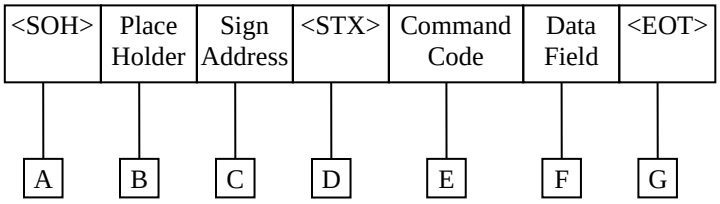
CAUTION: A regulated DC power source must be utilized, or the display can be damaged and will not be covered under warranty.

2.2.11.2. Mating Cables for the 6 Pin Receptacle

Mating cables are available at different lengths and must be ordered separate. Please check with your sales representative to order mating cables.

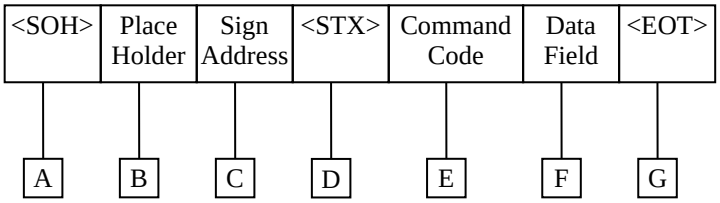
3. ASCII Control Commands

Below is the basic command structure for sending data to be displayed on the unit when SW1 DIP6 is ON and DIP7 is off. The command can be sent via RS485/Ethernet port.



Item	Name	Description
A	<SOH>	"Start of Header" ASCII character (Hex 01)
B	Place Holder	Any ASCII character with the default being a 'Z'
C	Sign Address	Two ASCII digits. (See Table 2) The sign address must be two bytes and an ASCII representation in Hexadecimal and not in decimal. Refer to Appendix B for the decimal to Hexadecimal conversion. Note: "00" as a sign address broadcasts to all the signs in the network.
D	<STX>	"Start of Text" ASCII character (Hex 02) always precedes the Command Code.
E	Command Code	Two ASCII characters that defines the function and data types. Command codes used by the Numeric Display: "E " = Write to clock display (NOTE: The E is followed by a space) "G1" = Write to numeric display "E;" = Write Date (month, day, year) to the display "E&" = Write Day of week to the display
F	Data Field	Made up of ASCII characters whose purpose is determined by the command code used. For Write to Clock Display command: 1234 - Clock displays 12:34 p.m. 0252 - Clock displays 2:52 a.m. 1645 - Clock displays 4:45 p.m. (12 hour mode) or 16:45 (24 hour mode) For Write to Numeric Display command: 1234 - Counter Displays 1234 -895 - Counter Displays -895 23 - Counter Displays 23 1-22 - Counter Displays 1-22 For Write Date to the display command: 102305 - month (2 digits), day (2 digits), year (2 digits) stored to sign For Write Day of week to the display command: 1 = Sunday, 2 = Monday, 3 = Tuesday, 4 = Wednesday, 5 = Thursday, 6 = Friday, 7 = Saturday
G	<EOT>	"End Of Transmission" ASCII character (Hex 04)

Below is the basic command structure for updating the set point values on the display. The command can be sent via RS485/Ethernet port.



Item	Name	Description
A	<SOH>	"Start of Header" ASCII character (Hex 01)
B	Place Holder	Any ASCII character with the default being a 'Z'
C	Sign Address	Two ASCII digits. (See Table 2) The sign address must be two bytes and an ASCII representation in Hexadecimal and not in decimal. Refer to Appendix B for the decimal to Hexadecimal conversion. Note: "00" as a sign address broadcasts to all the signs in the network.
D	<STX>	"Start of Text" ASCII character (Hex 02) always precedes the Command Code.
E	Command Code	Two ASCII characters that defines the function and data types. Command codes used by the Numeric Display: "SXX" (where XX can range from 01 to 10) - Store Preset value to Set Point 01-10 "SYY" (where YY can range from 11 to 20) - Store Alarm value to Set Point 11-20 "PXX" (where XX can range from 01 to 10) – Select Set Point 01-10 to be the default set point
F	Data Field	Made up of ASCII characters whose purpose is determined by the command code used. For Timer Mode: 1234 = Set Point Value changed to 12:34. This will be interpreted as hours and minutes or minutes and seconds depending on the status of SW1 DIP5 For Counter Mode: 1234 = Set Point Value changed to 1234 -895 = Set Point Value changed to -895 23 = Set Point Value changed to 23 Note: Data field is not required for Select Set Point (PXX) command.
G	<EOT>	"End Of Transmission" ASCII character (Hex 04)

4. Displaying Numerical Information on the Four Digit Display

The SW1 Mode Dip Switch must have switch No. 6 set to ON for these commands to function.

The following command will display -123 on the display with an address of 8.
Command: <0x01>Z08<0x02>G1-123<0x04>

Where:

<0x01> = “Start of Header” ASCII character. (Hex 01)
“Z” = ASCII place holder character. (Can be any ASCII character)
08 = Sign address (“00” as a sign address broadcasts to all the signs in the network)
<0x02> = “Start of Text” ASCII character (Hex 02) always precedes the Command Code.
“G” = Write to numeric display. (Hex 47)
“1” = File Label. (Always “1”)
-123 = Actual data to be displayed.
<0x04> = “End of Transmission” ASCII character (Hex 04).

5. Setting up the display SW2 Functions

By opening the end cover on either side of the display, you can access the main board CZ8250 as shown in the picture below. The address/mode switch (SW2) is in the middle of the main board.

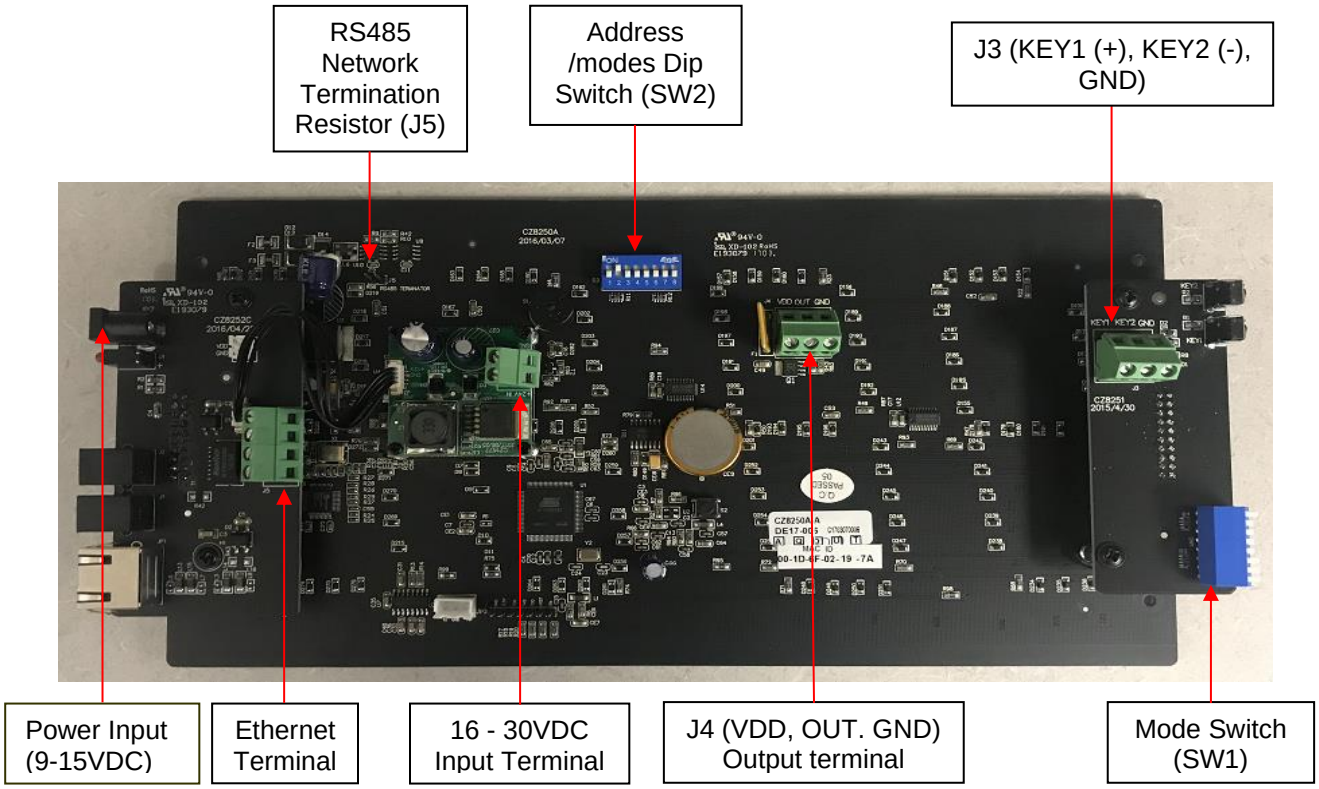


FIGURE 3

For SW2 the dip switches are enabled when they are in the ON position.
The definitions of the dip switches for SW2 are as follows:

5.1. Test Mode Dip Switch

The first switch labeled 1 is for the test mode function. When the switch is in the ON position, the display will show the numbers 0 thru 9 on all four digits as well as keep the colon on steady. The test will repeat until the test switch is turned OFF.

5.2. Daylight Saving Time Dip Switch

The 2nd switch on SW2, labeled 2, is for the Daylight-Saving Time option. When the display is in the clock mode (SW1, 6th switch set to OFF), and the SW2 2nd switch is set to ON, Daylight Saving Time is enabled on the Clock. The clock will automatically adjust the time forward one hour during the daylight-saving time period which starts on the second Sunday in March and ends on the first Sunday in November and conversely set

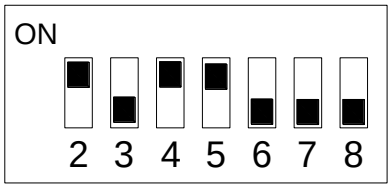
the time back one hour during the other period of time. Setting the 2nd switch OFF will disable Daylight Saving Time. See Section 1.4 for more information on this.

5.3. Display Address Setting

The 3rd through 8th switches define the RS485 communication address. They are a Binary representation of the address. Refer to the table below for the switch values when they are in the ON position.

Switch Number SW2	Switch Value When ON
1	Test Mode
2	Daylight Saving time enabled
3	32 Address
4	16 Address
5	8 Address
6	4 Address
7	2 Address
8	1 Address

Table 2: RS485 Address Setting Table



This figure above demonstrates “1011000”, which means that the RS485 address is 88. In sending information to the sign, the address must be sent in a hexadecimal format, thus for the above example the decimal address 88 is represented by a hex value of 58.

Appendix A - SW1 and SW2 Switch Settings Tables

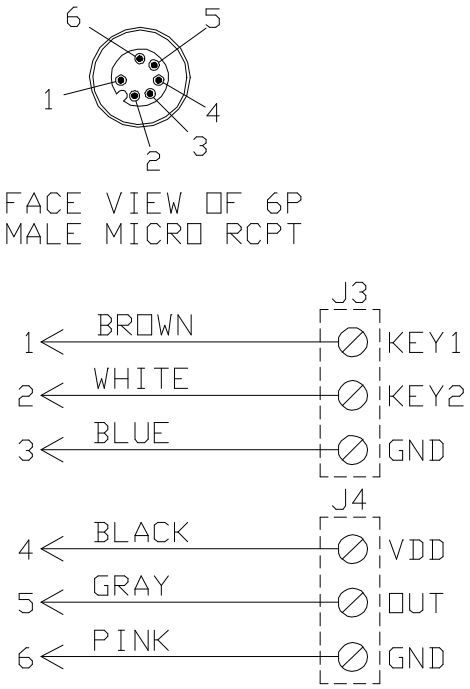
SW2 FUNCTIONS							
DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	DIP8
DIP1=OFF; Normal Operation DIP1=ON; Test Mode	DIP2=OFF; Daylight Savings Time Disabled DIP2=ON; Daylight Savings Time Enabled	Address Option (0-63)					

SW1 FUNCTIONS							
DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	DIP8
Time Zone Setting (CLOCK MODE ONLY) (SEE MANUAL)					DIP6=OFF; Time Display	DIP7=OFF; 12 Hour DIP7=ON; 24 Hour	DIP8=OFF; 40% Brightness DIP8=ON; 100% Brightness
			DIP4 OFF & DIP6 &7 ON 3 SEC RESET, COUNT DOWN FROM PRESET, THEN NEG FROM 59:59, SO2 ON WHEN = SETPOINT	DIP6=ON and DIP5=ON; mm:ss	DIP6=ON and DIP7=OFF; up/down COUNTER MODE		
			DIP4 ON & DIP6 &7 ON .2 SEC RESET, COUNT DOWN FROM PRESET, THEN NEG FROM 00:00, SO2 ON WHEN < OR = SETPOINT	DIP6=ON and DIP5=OFF; hh:mm	DIP6=ON and DIP7=ON; up/down TIMER MODE		

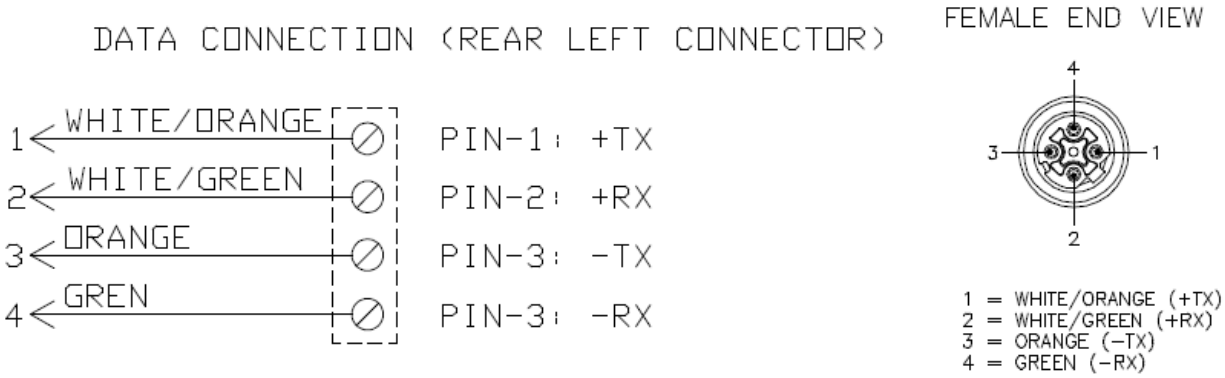
Appendix B - Sign Address Table Decimal to Hex Conversion

Decimal Address Value	Hexadecimal Address Equivalent	Decimal Address Value	Hexadecimal Address Equivalent
0	00	32	20
1	01	33	21
2	02	34	22
3	03	35	23
4	04	36	24
5	05	37	25
6	06	38	26
7	07	39	27
8	08	40	28
9	09	41	29
10	0A	42	2A
11	0B	43	2B
12	0C	44	2C
13	0D	45	2D
14	0E	46	2E
15	0F	47	2F
16	10	48	30
17	11	49	31
18	12	50	32
19	13	51	33
20	14	52	34
21	15	53	35
22	16	54	36
23	17	55	37
24	18	56	38
25	19	57	39
26	1A	58	3A
27	1B	59	3B
28	1C	60	3C
29	1D	61	3D
30	1E	62	3E
31	1F	63	3F

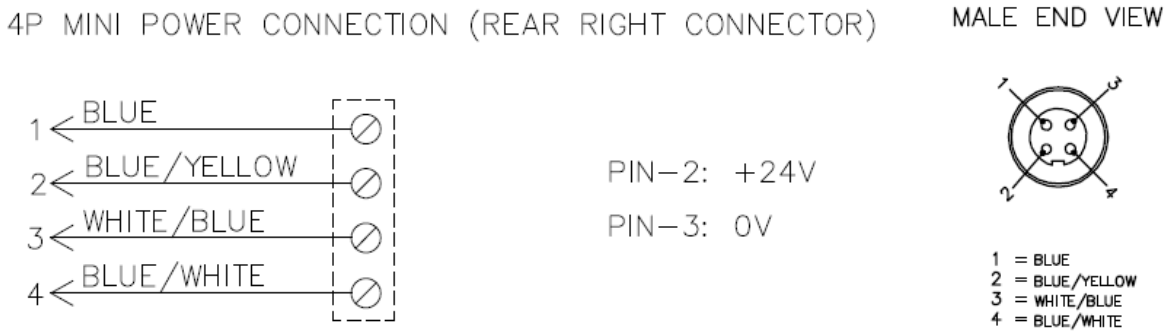
Appendix C - Optional 6 Pin Receptacle Pin out for External Wiring



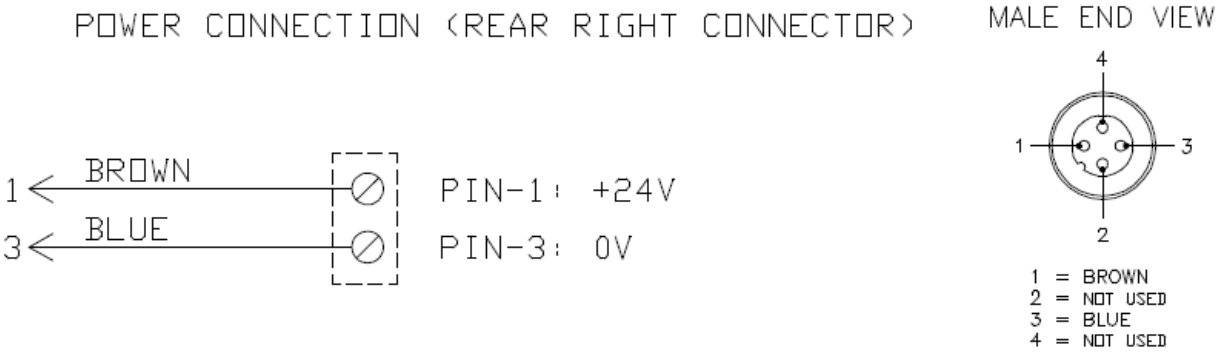
Appendix D - Optional D-Coded M12 Receptacle Pin out for Ethernet



Appendix E - Optional 4 Pin M12 Receptacle Pin out for 24VDC (16 - 30VDC) Input



Appendix F - Optional 4 Pin Mini Receptacle Pin out for 24VDC (16 - 30VDC) Input



Appendix G - Set Point Table

Set Point	Function
S01	Timer/Counter Set Point 1
S02	Timer/Counter Set Point 2
S03	Timer/Counter Set Point 3
S04	Timer/Counter Set Point 4
S05	Timer/Counter Set Point 5
S06	Timer/Counter Set Point 6
S07	Timer/Counter Set Point 7
S08	Timer/Counter Set Point 8
S09	Timer/Counter Set Point 9
S10	Timer/Counter Set Point 10
S11	Alarm Set Point 1
S12	Alarm Set Point 2
S13	Alarm Set Point 3
S14	Alarm Set Point 4
S15	Alarm Set Point 5
S16	Alarm Set Point 6
S17	Alarm Set Point 7
S18	Alarm Set Point 8
S19	Alarm Set Point 9
S20	Alarm Set Point 10

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