ECHMI

Master Display Unit with ECN Protocol Interface

& Options: "/4-20" providing 4-20mA Host Interface
"/PMDM" providing built-in Environmental Modem

User Reference Manual

Firmware Revision #

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Master Display Unit with ECN Protocol Interface

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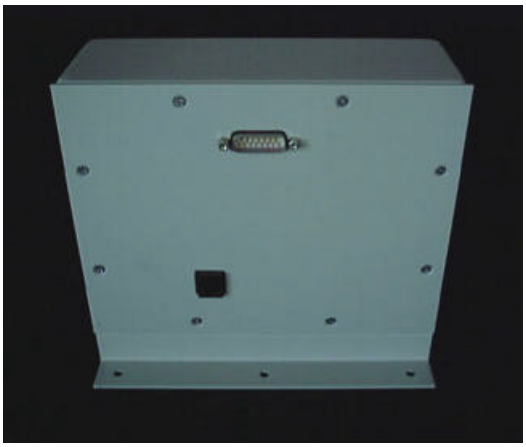
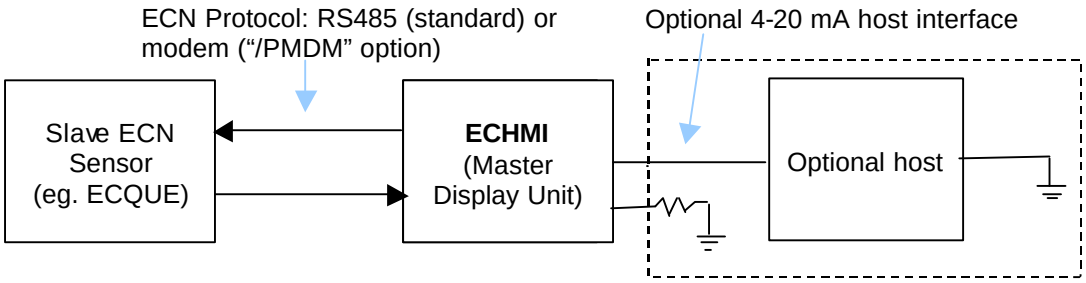


ECHMI/PMDM

1. ECHMI

The ECHMI Master Human Interface features a real-time viewing of data sensed by an ECN-based sensor connect to it (ex. ECQUE). The data is acquired by the ECHMI by being Master and by prompting the sensor at a rate of once per second. This data is displayed on the 8-digit display and is optionally transmitted to a host as depicted below:



The ECN interface between the slave sensor and the ECHMI master is one that is designed by AMASS Data Technologies Inc and has led to the ECxxx line of products and is described in section 2. The standard ECHMI transmits the ECN via an RS485 port and single or dual-twisted pair thus providing up to 4000 feet of communications between Master and Slave. Alternatively, option "**/PMDM**" provides a built-in environmental modem for Least Line or Wet/Line communications.

The ECHMI transmits the data to a host using a 4-20 mA output when ordered with option "**/4-20**". An important feature of this built-in 4-20 mA module, as well as most other AMASSER ECxxx line of products, is that it provides 2500 V_{rms} isolation between the network and the I/O functions being provided which in this case is the 4-20mA current loop.

Hardware is powered from a +10.5 to 15 V input for external battery, charger or power supply.

1.1. Options

In addition to the standard ECHMI described above are the following options:

The **/PMDM** options: Built-in PMDM environmental modem (See PMDM user manual). The standard ECHMI uses an RS485 output for driving the ECN protocol.

The **/4-20** option: The '/4-20' option is a 4-20 mA module which provides a standard current loop as a means of relaying the acquired data from the sensor in applications requiring an analog interface for the host.

1.2. ECHMI -Principle of Operation

The ECHMI sends an ECN command supported by the sensor in order to acquire real-time data that is displayed on the 8-digit LED. For example, if connected to the ECQUE the ECHMI sends the 'aR0<CR><checksum>' (see section 2) command in order to retrieve the current shaft position. This communication takes place via RS485 interface (standard) or modem (option **/PMDM**).

The data that is retrieved from the sensor, that is, the ASCII string embedded in the ECN response that represents the data, is then displayed on the screen. The ECHMI then converts the binary representation of this number to a 4-20 mA output (option **/4-20**) based on the values for OFFSET and SPAN as explained below.

2. ECN Protocol

The *Embedded Control Network (ECN)* is configured as an RS-485 or modem-based multi-drop environment supporting up to 32 modules over a distance of 4000 feet on single or dual twisted pair cable. The network operates at 9.6 or 19.2 Kbaud rates with the ability to increase these rates up to 115.2 Kbaud. An additional pair is also specified for the routing of 24 Volt or Volt DC power.

The *Embedded Control Network* (ECN) protocol is configured as a master-slave environment supporting a simple & reliable multi-node ASCII based command - response message system. Message strings begin with an address byte followed by the message body, followed by a carriage return byte and terminated with an 8-bit binary checksum

In order to communicate with the slave ECxxx sensor, the ECHMI sends it a message. The first byte of the message string is an "address" byte, which consists of an ASCII character, which represents the module's node address. In order to support up to 32 remote nodes on a network, the addressing scheme ranges from ASCII "0" (30H) to ASCII "9" (39H), then from ASCII "A" (41H) to ASCII "V" (56H). Following the node address byte is a one or two byte command that allow various I/O operations to be initiated. Following the command byte is the body of the message that contains the parameters required for the execution of the command. Following the body of the message is a carriage return byte (0dH) followed by a one-byte checksum, which is the one's complement of the sum of all the bytes in the message including the carriage return byte, but not including the one-byte checksum.

The second last character of the message is always "CR" (0DH). This "CR" character must never be used anywhere else in the message string and must always be followed by the 8-bit checksum. The host controller must turn off its transmitter and enable its receiver within 10 millisec after sending the checksum in half duplex operation mode.

More details of the AMASSER ECN Protocol are provided in our website at www.amassdata.com.

3. Display Operation

The ECHMI comprises an 8-digit display and two double-position switches that control the display and setup of parameters. The setup parameters are only accessible however, once the correct password has been entered. The front of the unit appears as in Fig.1.

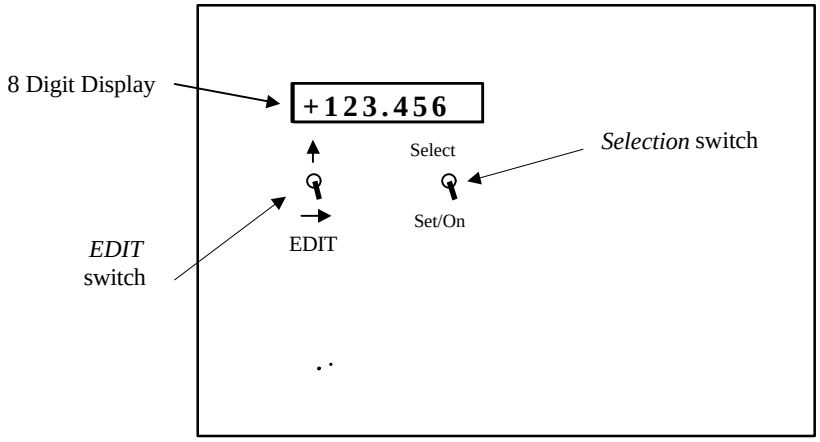


Fig.1 Front view of the ECHMI.

The right switch is used to *select* the parameter to be displayed and/or altered. It is also used as an enter key to *set* the new values of setup parameters; and as an *on* switch for the display. The left switch allows the user to *EDIT* the value displayed at the screen. The lower position of this switch is labeled with a right-arrow and is used to select the digit that is to be edited; the "active" digit is the one flashing on the screen. The upper position, which is labeled with an up-arrow, edits the active digit by scrolling through the available options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, ., +, -.

In short, the value of a parameter is displayed and entered using *set/on.* If the value that is displayed is correct it may be left unaltered by simply reentering it using *set/on*. On the other hand, any changes made to a value that has not yet been saved may be disregarded by using *select.*

3.1. Displaying the Sensor Data

To use the display to view the real-time data simply turn it on with *set/On*. For example, if the ECQUE is connected the LED will display the current water level.

NOTE: Some units do not have the auto-shut-off feature enabled in order to allow continuous viewing of the data.

3.2. Accepting/Changing the Password

To begin the setup of the ECHMI, switch it on with *set/On.* Now use *select* until "PASSWORD" appears then use *set/On* ("+000" appears). The default password of "+000" can now be edited to your own using the *EDIT* switch if you desire password-protection. When entering the four-character password the following characters are valid: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, ., +, -, <space>. The password can only be viewed or altered from the display and must be entered correctly to view the remaining setup parameters. **To set the password equal to the characters displayed on the screen press the *set* switch.**

Note that the correct password that was entered to gain entry to the setup parameters can be viewed as long as the display has not switched off with the auto power-off feature (see below). If the display does shut off

however, and is turned back on "PASSWORD" will display the default value, namely "+000", which must be edited once again to obtain access. Never forget your password otherwise you will not be able to change the setup parameters from the display at a later date. In the event that it is forgotten contact AMASS Data Technologies Inc.

NOTE: For units with the "**/4-20**" option, the ECHMI allows the user to configure and calibrate the current loop using the switches and display as described in the following sections.

3.3. Setting the OFFSET (/4-20 only)

As explained in APPENDIX A, the parameter **OFFSET** must be set equal to the minimum anticipated value of the data retrieved from the sensor to which the ECHMI is connected.

Begin by accepting the password as described above. Use *select* until the word '**OFFSET**' appears. Press the *set/On* switch. Use the *Edit* switch to set the display to the proper value as described in APPENDIX A, then use *set/On* to enter this value.

NOTE that when entering values for the **OFFSET** the decimal point must be present as these parameters are floating point variables. The "+" or "-" sign must also be entered for these parameters. For instance, a scale of +1.000 may be entered as "+1." but not as "+1", "1." or "1". Use *set/on* repetitively to review the list of parameters and their respective values.

3.4. Setting the SPAN (/4-20 only)

As explained in APPENDIX A, the parameter **SPAN** must be set equal to the maximum anticipated range in the data retrieved from the sensor to which the ECHMI is connected.

Begin by accepting the password as described above. Use *select* until the word **SPAN** appears. Press the *set/On* switch. Use the *Edit* switch to set the display equal to the proper value as described in APPENDIX A, then use *set/On* to enter this value.

NOTE that when entering values for the **SPAN** the decimal point must be present as these parameters are floating point variables. The "+" or "-" sign must also be entered for these parameters. For instance, a scale of +1.000 may be entered as "+1." but not as "+1", "1." or "1". Use *set/on* repetitively to review the list of parameters and their respective values.

3.5. "CAL 4mA" and "CAL 20mA" (/4-20 only)

The "CAL 4mA" and "CAL 20mA" features of the ECHMI/4-20 enables the user to easily and accurately calibrate the 4-20mA current loop.

Begin by accepting the password as described above. Use *select* until the words "**CAL 4mA**" appear on the screen. Press the *set/On* switch. The words "**4mA out**" appear on the screen to indicate that the ECHMI is transmitting an analog signal equivalent to '0000'hex in the Analog to Digital Converter. The user may now calibrate the OFFSET as described in section 4.3. Press the *set/On* switch when you are done with this calibration.

Use *select* until the words "**CAL 20mA**" appear on the screen. Press the *set/On* switch. The words "**20mA out**" appear on the screen to indicate that the ECHMI is transmitting an analog signal equivalent to 'FFFF'hex in the Analog to Digital Converter. The user may now calibrate the SPAN as described in section 4.3. Press the *set/On* switch when you are done with this calibration.

4. Installation

4.1. Connectors

4.1.1. Standard ECHMI

1 9 pin DB9 Connector (reserved for upcoming projects)

4.1.2. Option /PMDM

1 RJ11 Connector for telephone line.
1 DB15P Connector

DB15P Pin Assignments

PIN	SIGNAL
1	Ground from PMDM to ECHMI
3	TxD*
4	RxD
6	RxDHC (from ECHMI to PMDM)
7	+5V from PMDM to ECHMI
8	Ground from power supply
10	TxD
11	RxD*
12	TxDHC (from PMDM to ECHMI)
15	+12V input from power supply

All other pins unassigned.

4.1.3. Option /4-20

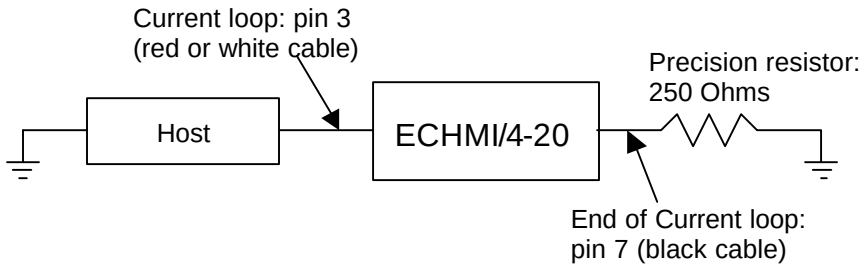
1 8 pin AMP CPC connector for the current loop

PIN	SIGNAL	Cable Color
3	Current Loop	Red (or white)
7	End of Current loop	Black

All other pins unassigned.

4.2. Connection of 4-20 mA Current Loop (/4-20 only)

Connect the two wires of the current loop (see section 4.1.3) as shown below:



4.3. Calibration of 4-20 Current Loop (/4-20 only)

Once the ECHMI/4-20 is connected as shown above it must be calibrated. This is easily done with accurate results as follows:

1. Use the *Select* and *Set/on* switch positions until "**4mA out**" is displayed on the screen as described in section 3.5.
2. Using a voltmeter, measure the voltage across the precision 250-Ohm resistor. There should be exactly 1 V across the resistor. If it is not, remove the ECHMI panel from the enclosure and adjust the variable resistor labelled "**VR1**" until a 1 V reading is obtained.
3. Use the *Select* and *Set/on* switch positions until "**20mA out**" is displayed on the screen as described in section 3.5.
4. Using a voltmeter, measure the voltage across the precision 250-Ohm resistor. There should be exactly 5 V across the resistor. Adjust the variable resistor labelled "**VR2**" until a 5 V reading is obtained.
5. The calibration is done.

5. Specifications

Processor : Atmel 89S8252 @ 3.6864 MHz.
Word Size : 8 bit data - 8 bit instruction
Memory : 89S8252, 256 bytes RAM
EEPROM 2 kbytes

Human Interface (DISPLAY)
8-DIGIT LED
2 double-position switches

Communications Range
Max. distance between ECHMI and slave sensor:

- 4000 feet (Standard models, RS485 port)
- 4000 feet (/**PMDM** models using LL)
- Unlimited (/**PMDM** models using wet lines)

Output

- Master ECN protocol driver: Command Messages transmitted once per second via RS485 (standard) or modem (/**PMDM** option)
- 4-20 mA current loop for host interface (/**4-20** option)

Connectors

- DB9S Conn. for RS485 and 12VDC input (standard models only)
- DB15P Conn. for modem Tx and Rx lines and 12VDC (/**PMDM** option)
- 8 pin AMP CPC Conn. for 4-20mA current loop (/**4-20** option)

Power Supply
+10.5 to 15 VDC input for external battery, charger or power supply

Power Consumption
100 mA with display continuously on OR about 20 mA with display off

4-20mA OPTION
A/D: LT1077
Resolution: 16 bits
2500 Vrms optically coupled

Physical Characteristics
Height : 178.0 mm. (7.0 in.)
Width : 200.0 mm. (7.75 in.)
Depth : 70.0 mm. (2.75 in.)
Weight : 1.35 Kg (3.0 lb.)
Mounting : Two Mounting brackets, Standard
Use four (or six) #10 bolts or screws.

Environmental Characteristics
Operating : -40 to +55 C
Storage : -60 to +100C
Humidity : <= 100% non-condensing

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APPENDIX A: Determining OFFSET and SPAN (option /4-20)

In order for the ECHMI to convert incoming data to a 4-20 mA output (option "**/4-20**" only) it is necessary to define the values **OFFSET** and **SPAN** using the display and switches (see sections 3.3 and 3.4). The parameter **OFFSET** must be set equal to the minimum anticipated value in the data retrieved from the sensor connected to the ECHMI. The parameter **SPAN** must be set equal to the maximum anticipated range in this data.

Example:

A ECHMI is connected to a ECQUE shaft encoder. Assume the lowest possible water level is 130.000 and that the highest is 140.000. You must enter a value of 130.000 for the OFFSET and 10.000 for the SPAN using the display and switches (see sections 3.3 and 3.4). Therefore, if a value of 132.500 is retrieved from the ECQUE the ECHMI will convert this to

[{(Sensor data) – **OFFSET**} **X 16/SPAN**] **+ 4 = current output**

[{(132.500) – 130.000} **X 16/10.000**] **+ 4 =** 8mA