ELCON INSTRUMENTS

INTRINSIC SAFETY and Ex SPECIALISTS

HART INTERFACE SOLUTIONS™

HPTB / 32 / ABB1B-02

Installation Manual

IMABB02A1
(991208A)

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1. General Description

1.1 Introduction

This manual provides guidance for the installation, operation, and maintenance of your Elcon 1700 Multiplexer, and termination board model number, HPTB/32/ABB1B-02. This solution is specifically designed for easy Multiplexer integration with ABB I/O Modules DSAI133 and DSAX110.

The Elcon 1700 Multiplexer will be referred to in this manual as the 1700 MUX. All further references to the HPTB/32/ABB1B-02 will be simply HPTB. When referring to the two units as a whole, they will be called the HART Interface Solution, or simply HIS.

To avoid damage, failure, or improper operation, read this manual carefully before installing and operating the equipment.

1.1.1 Purpose

The 1700 MUX is a HART signal multiplexer unit, which allows access to HART communication on existing 4-20mA wiring.

1.1.2 Functions

Your HART Interface Solution interfaces up to 32 field located HART devices. The 1700 MUX is the heart of the system. It acts as a gateway device, routing communications between the maintenance workstation PC and the HART devices. The 1700 MUX uses the HART protocol on both the RS-485 link to the maintenance workstation PC and on the Bell 202 Frequency Shift Keying (FSK) link (base HART protocol) to each of the HART devices. It interrogates each HART device, retrieves device information, and stores it in an internal database. This information is available to the maintenance workstation software.

Furthermore, the 1700 MUX acts as a message coordinator for communication between the maintenance workstation PC and the HART devices. In this way, the 1700 MUX is transparent to the user. In fact, the user has access to each HART device as if connected directly at the device itself. Additionally, the 1700 MUX may be connected in a HART RS-485 multidrop network. A maintenance workstation PC can use this multidrop network for configuration, maintenance, calibration, diagnostics, and data access.

HART Interface Solutions are supplied by ELCON with several models in order to allow simple and reliable connection with Smart devices.

1.1.3 HART Overview

HART is an acronym for "**H**ighway **A**ddressable **R**emote **T**ransducer". The HART protocol makes use of the Bell 202 FSK standard to superimpose digital signals at a low level on top of the 4-20mA signal. This enables two-way communication and makes it possible for additional information beyond just the normal process variable to be communicated to/from a smart field instrument. The HART protocol communicates without interrupting the 4-20mA signal and allows a host application (master) to get two or more digital updates per second from a field device. As the digital FSK signal is phase continuous, there is no interference with the 4-20mA signal.

1.1.4 Specifications

1.1.4.1 1700 MUX Specifications

POWER SUPPLY: 24 VDC nominal (22 V - 28 V) at 100 mA
POWER DISSIPATION: 3 W maximum
FUSE: Wickmann Type TR5/IEC 127-3, 250 V Time Lag Fuse; Current: 315 mA; Breaking capacity; 35 A at 250 V
MODULE CONNECTION: DIN 41612 96-way plug
ENVIRONMENTAL CONDITION LIMITS:
- Operating temperature: 0 to 55°C (32 to 131°F)
- Storage Temperature: -20 to 75°C (-4 to 167°F)
- Relative Humidity: 5 to 90% non-condensing (up to 35°C)

SIGNAL CHANNELS: Up to 32 signal pairs unbalanced
INPUT IMPEDENCE: 5K –j220 (typ @ 500Hz)
OFF-STATE LEAKAGE: <3 microAmp DC (-40 to +105°C)
COMMUNICATION PORT: RS-485 differential pair (isolated)
DIGITAL COMMUNICATION SPEED: 9600 baud or 19200 baud

1.1.4.2 HPTB Termination Board Specifications

MOUNTING: Mounts to standard T-type (EN50022 (DIN46277-3)) or G-type (EN50035 (DIN46277-1)) DIN rail.
CONNECTIONS: Phoenix Contact 5.08mm screw terminals for power and RS-485; 4-40 Screw terminals for shield connections; Two 37-pin Sub-D type connectors for field cable; Four 26 pin connectors for DCS cable.
POWER FUSE: 2A, 5x20mm
DIMENSIONS: (See Figure 1)
- Length = 13.1” (333mm)
- Width = 5.0” (127mm)
- Height = 2.25” (57mm) [7.5” (190mm) w/MUX installed]

1.1.4.3 RS-485 Line Specifications

COMMUNICATION PORT: RS-485 differential pair (isolated). An RS-232 to RS-485 converter is needed to connect the PC host station to the board Terminal block (see Figure 3).
DIGITAL COMMUNICATION SPEED: 9600 bps or 19200 bps (user selectable)
MULTI-DROP ADDRESSING: up to 31 1700 MUX modules (32 channels each)
MULTI-NETWORK OPERATION: Available within software options
MAXIMUM NUMBER OF 1700 MULTIPLEXERS IN NETWORK: 31
NETWORK TOTAL: 992 per Serial Line
MULTI-NETWORK OPERATION: 4 Serial Lines; Available within maintenance software package
SMART PROTOCOL PRESENTLY SUPPORTED: HART
OUTPUT NETWORK: RS-485 (use an RS-232 to RS-485 converter Keithley type M1000 to connect the PC maintenance station).
BAUD RATE: 9600 bps or 19200 bps (user selectable)
TOTAL NUMBER OF BITS: 11 bits
NUMBER OF DATA BITS: 8 bits
PARITY: ODD
NUMBER OF STOP BITS: 1 bit
TRANSMISSION TYPE: 2-wire

HPTB/32/ABB1B-02 Layout

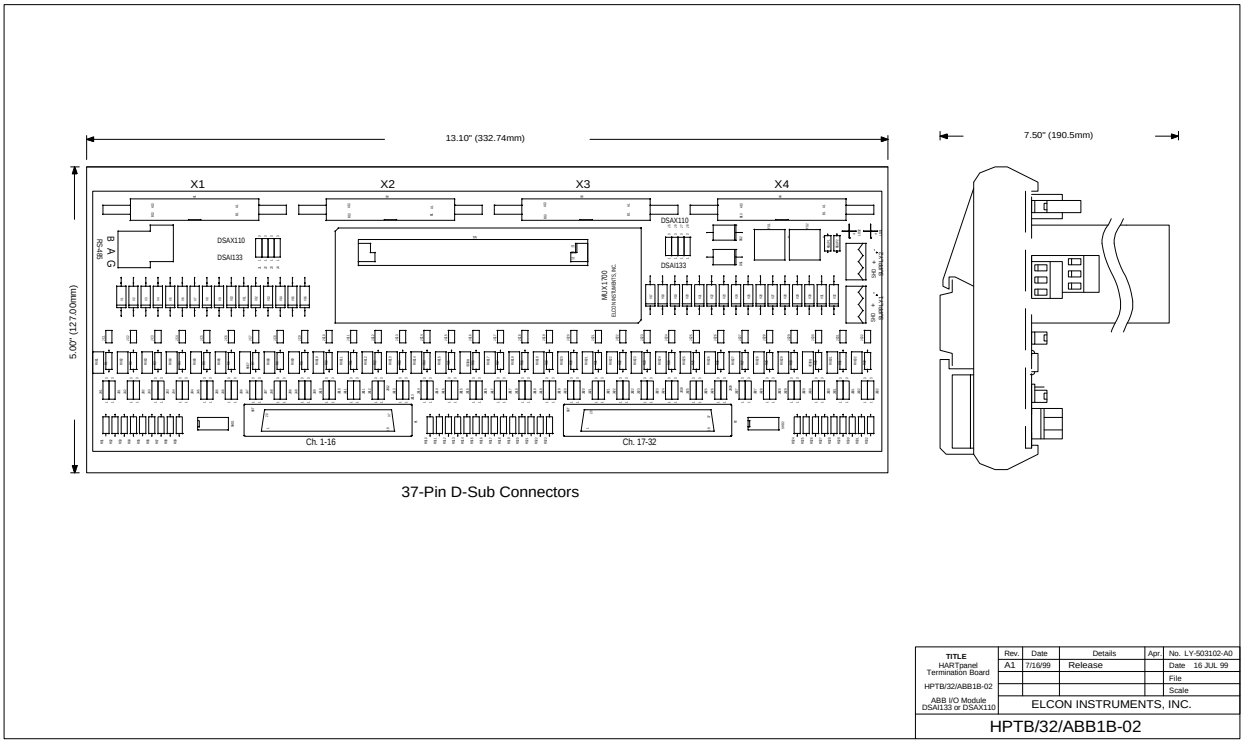


Figure 1

1.2 Asset Management Solutions (AMS) Software

AMS software provides an easy-to-use means for integrating various device management software packages into a unified system. AMS operates under the Microsoft® Windows® format. It combines the various device (or asset) management tasks into an application with a common look-and-feel and centralized data storage.

AMS provides access to functionality available via the HART communications protocol for any HART device whose Device Description (DD) is registered with the HART Communication Foundation.

For more information on installation of AMS software, consult the AMS Installation Guide.

1.3 Associated Tools and Test Equipment

No special tools or test equipment are required.

1.4 Quality Assurance

All Elcon Instruments production is performed under a Quality Assurance program following written procedures, which are specific for each line of instruments, during the manufacturing, intermediate testing and inspection, and final inspection phases.

Each 1700 MUX unit undergoes accelerated thermic aging (burn-in) for a minimum 200 hours at 50°C (122°F) with at least 1 cooling thermic cycle at 0°C (32°F) and back to 50°C (122°F). The purpose is to identify weak components that may develop initial fault mechanisms due to "Infant Mortality". Only after a positive burn-in test, instruments undergo a complete final inspection performed with computerized automatic testing equipment specifically developed by Elcon for this purpose.

1.5 Certifications and Compliance

HART Interface Solutions are CE compliant.

This Equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only. Equipment must be mounted in an enclosure that meets the requirements of ANSI/ISA S82.01 & S82.03 and the National Electrical Code.

1.6 Unpacking and Inspection

Upon receipt of the materials, you should check the integrity of the packing and the contents. In case of damage due to shipping, you should promptly and properly report to the shipper, supplying all necessary information.

If instruments are not for immediate use, we recommend that you check that all characteristics shown on the instruments label meet order specifications (model, supply voltage and frequency, input/output range, certification, tag etc.) as well as the actual application requirements.

If not installed, equipment should be stored following recommendations of the next section.

1.7 Storage

In case of storage of instruments and accessories, proper care should be taken to protect them from any possible damage. Always store instruments in their sealed original packaging until they are installed.

Provide adequate protection to prevent damages that may be caused by exposure to:
- Rain, excessive humidity and/or temperature excursions (inadequate sheltering).
- Dust (build-up of a corrosive patina that may cause oxidations and reduce isolation).
- Aggressive and polluting atmospheres with consequent corrosion.
- Access by insects/rodents (damage of packing or content).
- Mechanical shocks or unauthorized packing opening.
- Intense vibrations (loosening of fastened parts, fatigue failures, etc.).
- Any other possible risk.

Make sure the storage temperature does not exceed the limits of –20 to +55°C (-4 to 131°F) for medium/long term storage (days/months) and -25 to +75°C (-13 to 167°F) for short term storage (a few hours) transportation/shipment.

If inspection is completed, pack instruments in their original packing. List the contents on the packaging to avoid unnecessary further inspections.

2. Installation

2.1 Environmental Conditions

HIS products, like most modern electronic equipment, can operate in wide temperature and humidity ranges. However, practical consideration suggests a guideline on operating environment for best results.

- Keep operating temperature below 35°C (95° F), ideally between 20°C and 25°C (68 and 77°F), avoiding wide and rapid temperature excursions.
- Control relative humidity within 40 to 60% to avoid risks of static charges or condensation.
- Limit the presence of corrosive atmosphere, fumes and dust, sealing and purifying the control room area and using air filters in the cabinet air intakes (clean cable entry path), if necessary.
- Reduce vibrations (if any) to safe levels.

2.2 Intrinsic Safety

The HIS system can interface HART devices located in Hazardous areas by interposition of suitable galvanically isolated Intrinsically Safe Barriers. The barriers must allow bidirectional HART signal communication in addition to the normal 4-20 mA loop current processing.

2.3 Mounting

The 1700 MUX is a plug-in unit that must be inserted in the appropriate termination board position. Exercise care in the insertion to mate the connector's pins, then firmly press the module to engage the connector. Then fasten the fixing screws to firmly secure the module to the termination board.

The HPTB is designed to be mounted on T-type or G-type DIN rail. The board should be mounted near the marshalling panels.

2.4 Cables

HART signals are brought to the 1700 MUX from the field via the37 pin D-sub connectors P1 (Channels 1-16) & P2 (Channels 17-32). See Table 1 for pinout information. Connectors X1-X4 are for DCS cable connection. X2 & X4 are for redundant connections.

Table 1
P1 & P2 Pinout Codes

Male 37 Pin D-sub Pin #	Signal #	Channel	Male 37 Pin D-sub Pin #	Signal #	Channel
1	NC	Unused	**20**	NC	Unused
2	1-	1-/ 17-	**21**	2-	2- /18-
3	1+	1+/ 17+	**22**	2+	2+ /18+
4	3-	3- /19-	**23**	4-	4- /20-
5	3+	3+ /19+	**24**	4+	4+ /20+
6	5-	5- /21-	**25**	6-	6- /22-
7	5+	5+ /21+	**26**	6+	6+ /22+
8	7-	7- /23-	**27**	8-	8- /24-
9	7+	7+ /23+	**28**	8+	8+ /24+
10	9-	9- /25-	**29**	10-	10- /26-
11	9+	9+ /25+	**30**	10+	10+ /26+
12	11-	11- /27-	**31**	12-	12- /28-
13	11+	11+ /27+	**32**	12+	12+ /28+
14	13-	13- /29-	**33**	14-	14- /30-
15	13+	13+ /29+	**34**	14+	14+ /30+
16	15-	15- /31-	**35**	16-	16- /32-
17	15+	15+ /31+	**36**	16+	16+ /32+
18	NC	Unused	**37**	NC	Unused
19	NC	Unused			

Simplified Schematic

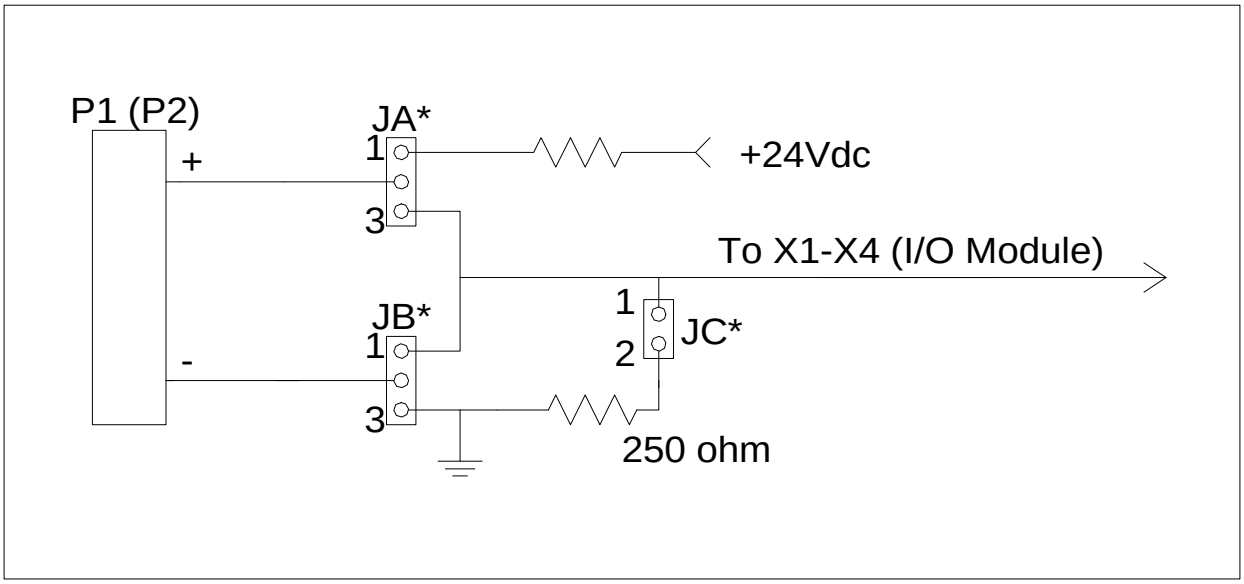


Figure 2

2.5 Wiring

The 1700 MUX is a plug in unit and is connected to the HPTB by a multipole connector. Therefore, all electrical connections (supply, field connection, serial lines, etc.) are made at the termination board unit. Refer to Figure 2 for a simplified representation of wiring and jumper settings.

2.5.1 Power

Connect 24 VDC to the 3-pin removable terminal at the end of the HPTB. The connector is polarized, so you cannot insert it incorrectly. The polarity is marked on the board and the terminals.

> WARNING! Improper supply connections can seriously damage the instrument and result in risk of fire or explosion in hazardous locations!

DC SUPPLY REQUIREMENTS: Check correct polarity of supply line, making sure that voltage excursions never go lower than 21.5 V (including ripple effect) or higher than 28 V.

> WARNING! Note that a crude, poorly filtered or unregulated supply can produce destructive (hundreds of volts) voltage spikes during supply transformer switch-off transient; this could cause minor problems to electro-mechanical components like relays or solenoids but will surely degrade or destroy electronic equipments. In case of doubt, provide over-voltage limiting by adequately dimensioned surge arresters on primary winding and voltage limiters (power zeners, zenamic, etc.) on the DC supply line to limit transients within 30-35V peak.

SUPPLY CONDUCTORS SIZING:
A single unit requiring 100 mA will have a conductor sizing based on mechanical strength rather than current carrying capacity. A reverse polarity shunt diode and series fuse protection are provided to avoid damaging the module in case of accidentally reversed polarity connection. In this case, the reverse voltage is clamped at -0.6 V and the T.B. slow blow fuse blows. Restore correct supply polarity and replace the blown fuse with the spare one supplied in the T.B. spare fuse holder (take care to reinstall a good, properly sized, new spare fuse!).

2.5.2 RS-485 (See Table 2)

RS-485 wiring is connected as shown in Figure 3. These wires carry data from the HIS to the PC via an RS-485/RS-232 converter. Connect the converter to a serial port on the PC as indicated in the converter's documentation.

Table 2
Maximum Wiring Lengths

Communication Protocol	Maximum Cable Length	
	Feet	Meters
RS-232	50	15
RS-485	4000	1200
HART	900 to 6500	275 to 2000

RS-485 cable length can be increased if high performance cables are used.
HART cable length depends on the capacitance of the cable and device, and the load resistor. The general rule is: R x C < 65ms. Consult "HART- A Technical Description" for more details. This is a free document published by the HART Communication Foundation.

RS-485 Wiring

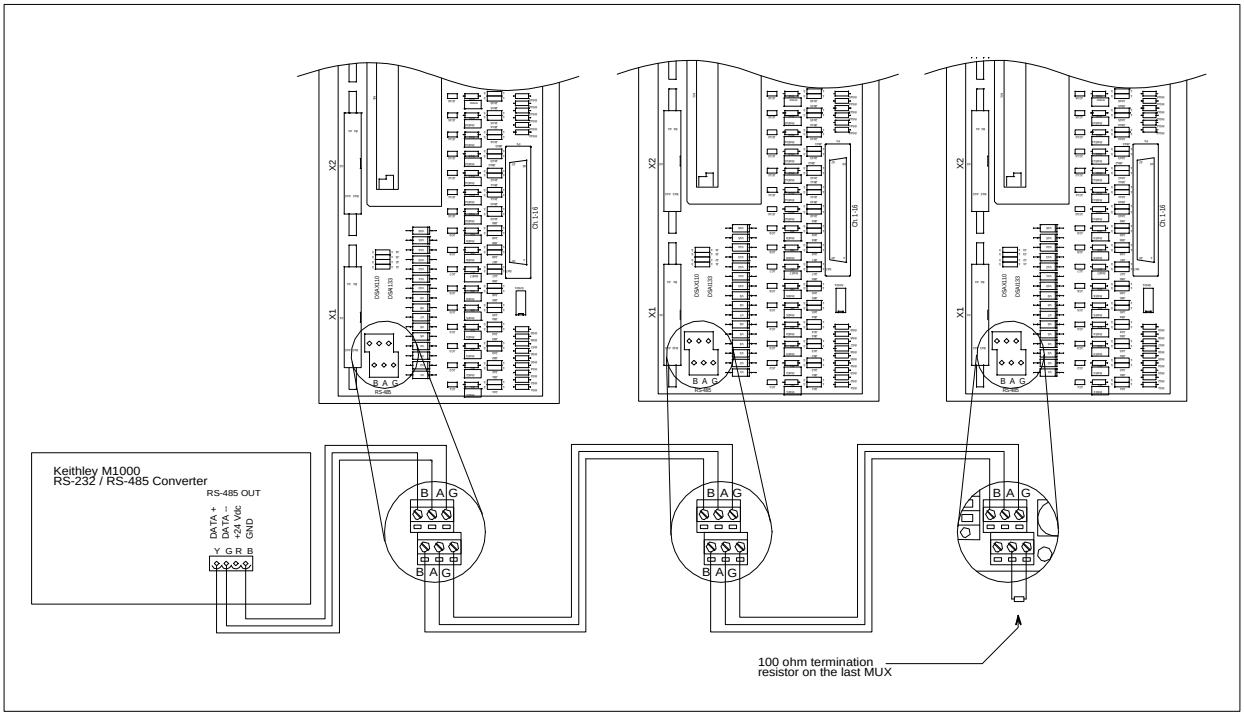


Figure 3

2.5.3 Field Connections

All field wiring is connected via the 37 pin D-sub connectors P1 & P2. Refer to section 2.4 and Table 1 for more information.

2.5.4 Control Connections

The HPTB provides simplex and redundant connectors (X1-X4) for connection directly to ABB I/O Module DSAI133 or DSAX110. No adapter or accessory hardware is required.

2.5.5 HART Communicator

In HART communications, there is one slave (field device) and up to two masters (e.g. Multiplexer, HART Communicator, I/O module). The HART Communicator can be connected to the field side terminals as a secondary master. In your software settings, the 1700 MUX must to be the primary master in order to use the HART Communicator.

There cannot be more than two masters. If three or more masters are connected, a primary/ secondary conflict will occur and communications will cease with all devices on that loop. When the 1700 MUX is used with a HART compatible I/O system, the 1700 MUX must be configured as the secondary master. Otherwise, configure the 1700 MUX as the primary master. The HHT is a secondary master by default, and can be connected to the loop when no other device on that loop is configured as a secondary master.

> WARNING! Do not connect the HART Communicator to any Intrinsically Safe field wiring unless the terminal is approved as Intrinsically Safe and suitable for the actual hazardous location classification of the specific hazardous location. Also consider HART Communicator safety parameters and equivalent capacitance and inductance before concluding that you can safely connect it to the I. S. side of the circuit.

2.5.5.1 1700 HHT

The 1700 HHT is an adapter (sold separately) that allows the user to replace the 1700 MUX with test points to connect a Hand Held Communicator. The 1700 HHT can only be inserted in place of the 1700 MUX. Therefore, it should only be used temporarily. Like the 1700 MUX, the 1700 HHT can be inserted and removed with power applied to the HPSM.

2.6 Grounding

The HPTB provides two separate shield terminals (one per field connector). The field side terminals are connected to SHD1, which provides a single point to properly ground field wiring cable shields. This terminal may not be necessary to use, but is available for different applications.

3. Operation

3.1 Initial Setup

The default settings for each 1700 MUX are as follows:

Address = 1
Baud Rate = 19200

3.1.1 **1700 Settings** (See Figure 4)

The User Switches buffer has eight inputs from a low profile DIL switch reachable through the front label. The functions of the switches are as follows:

Switch 7	(T)	Reserved for TEST purposes
Switch 6	(R1)	BAUD RATE 1
Switch 5	(R0)	BAUD RATE 0
Switch 4	(B4)	ADDRESS 4
Switch 3	(B3)	ADDRESS 3
Switch 2	(B2)	ADDRESS 2
Switch 1	(B1)	ADDRESS 1
Switch 0	(B0)	ADDRESS 0

Further information is given on the front and side labels (Figure 4). In particular, the side label gives the correct setting of every DIP switch combination.

1700 MUX Labels

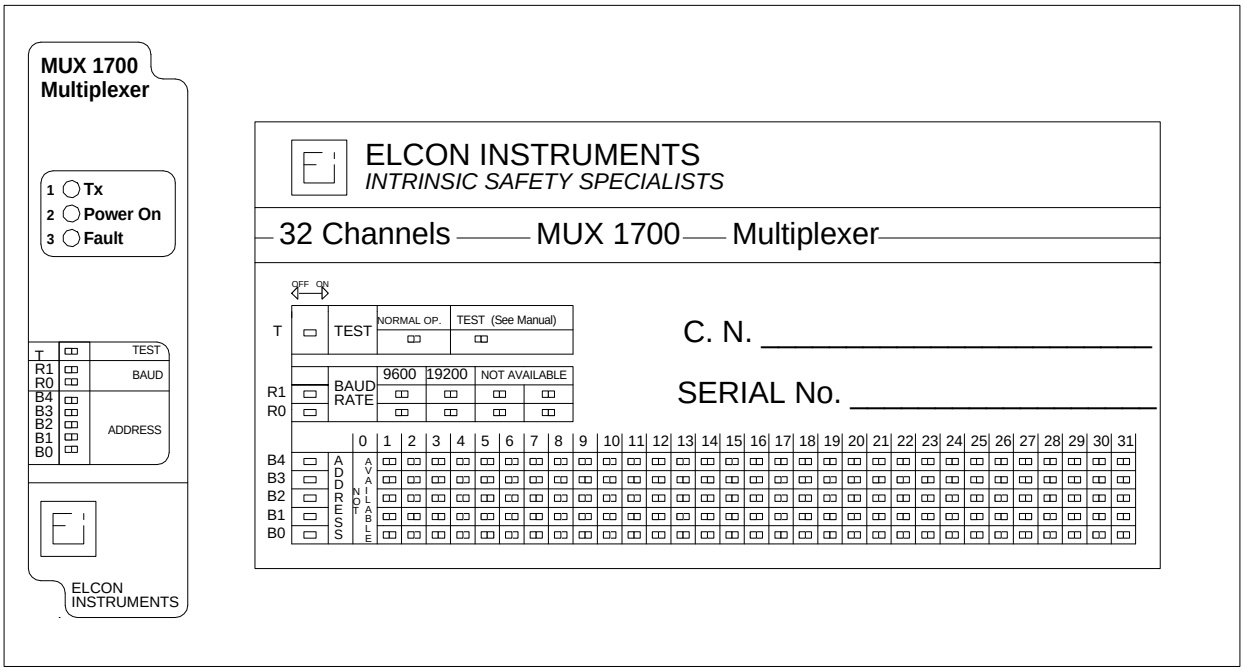


Figure 4

3.1.1.1 Address

The address of the 1700 MUX is determined by the DIP switches as noted above. Each MUX on the same RS-485 network must have a different address, but they do not have to be sequential and do not necessarily need to start at address 1. Possible addresses are 1-31. Address 0 is invalid and cannot be used. Note that network properties of the software setup refers to “multi-dropping.” This refers to multiple 1700 MUXs on the same network, not multiple devices on the same I/O loop (also referred to as “multi-dropping”). Multi-dropping should be enabled in the network setup.

3.1.1.2 Baud Rate

The baud rate of the 1700 MUX must match the baud rate of the PC Com-Port and the RS-232/RS-485 converter. All three units must have the same baud rate to function properly. The baud rate can be either 9200 or 19200 and is selected as shown in Figure 3.

3.1.2 RS-232/RS-485 Converter

An RS-232 to RS-485 converter must be placed between the HIS and the computer's RS-232 port. Elcon recommends the Keithley M1000 for non-CE applications. Other models of RS-232 to RS-485 converters can be used, but have not been tested by Elcon. Alternate brands are available with CE certification.

If only one RS-232 to RS-485 converter is used in setting up the system, then the RS-485 network must be less than 1200 meters (4000 feet). If the network surpasses 4000 feet, an RS-232 to RS-485 repeater can be used. The Keithley M1000 can fulfill this function. The repeater amplifies the original RS-485 signal when it is transmitted over long distances.

3.2 Start-up Sequence

Proper start-up sequence for the 1700 MUX is as follows:

1. Make all field and control connections to the HPSM
2. Connect RS-485 wires and adjust network settings
3. Apply field power or source 4-20mA
4. Turn on power to or plug in the 1700 MUX
5. After the 1700 MUX has completed the start-up sequence, then start AMS

3.3 Controls

Each channel of the HIS board can accommodate either smart 2-wire transmitters or smart valves. Both devices are connected via P1 & P2 in the same manner. However, there are three jumpers per channel on the HPTB that must be set for proper operation. In addition, Jumpers J1-4 and J5-8 determine which I/O module type may be plugged in to X1-X4. Note that any one HPTB can accommodate either two DSAX110, two DSAI133, or one of each. The only determining factor is the placement of J1-J8. Please refer to Table 3 below.

Table 3
Jumper Selection

Jumper	**Analog Input Position**	**Analog Output Position**
JA*	1-2	2-3
JB*	1-2	2-3
JC*	ON	OFF
	DSAI133	**DSAX110**
J1-J4 (Channels 1-16)	1-2	2-3
J5-J8 (Channels 17-32)	1-2	2-3

3.4 **Indicators** (See Figure 3)

Three LEDs on the front of the 1700 MUX indicate status. Normal operation is as follows:

- Power ON: Green LED lit when power is applied to the 1700 MUX. Power is automatically applied when the 1700 MUX is plugged into the HPSM.
- Tx: Shows 1700 MUX communication with field devices.
- Fault: Fault LED should not be lit during normal operation.

One LED on the termination board is a power indication showing 24 VDC available.

3.5 **Modes of Operation**

- SCAN MODE: Command to the 1700 MUX from the software telling the 1700 MUX to periodically scan each device automatically. Otherwise, the 1700 MUX will only communicate with a device when told to do so by the software.
- BURST MODE: When a field device is in burst mode, it automatically sends information without being commanded to do so. This is a break from the master-slave nature of HART communication, but the 1700 MUX will support it when burst mode is selected in the software.

4. Theory of Operation (Principles of Operation)

Referring to Figure 5, the heart of the 1700 MUX is the microprocessor. One serial port together with the HART modem generates the physical layer of the HART protocol, while the channel select circuit together with the channel multiplexer links one specific channel (device) at a time. An RS-485 circuit completes the gateway between the maintenance workstation PC and the devices. The user switches circuit provides information required by the 1700 MUX for initialization and configuration. Specifically, the baud rate for communications to the maintenance workstation PC and the 1700 MUX address are selected.

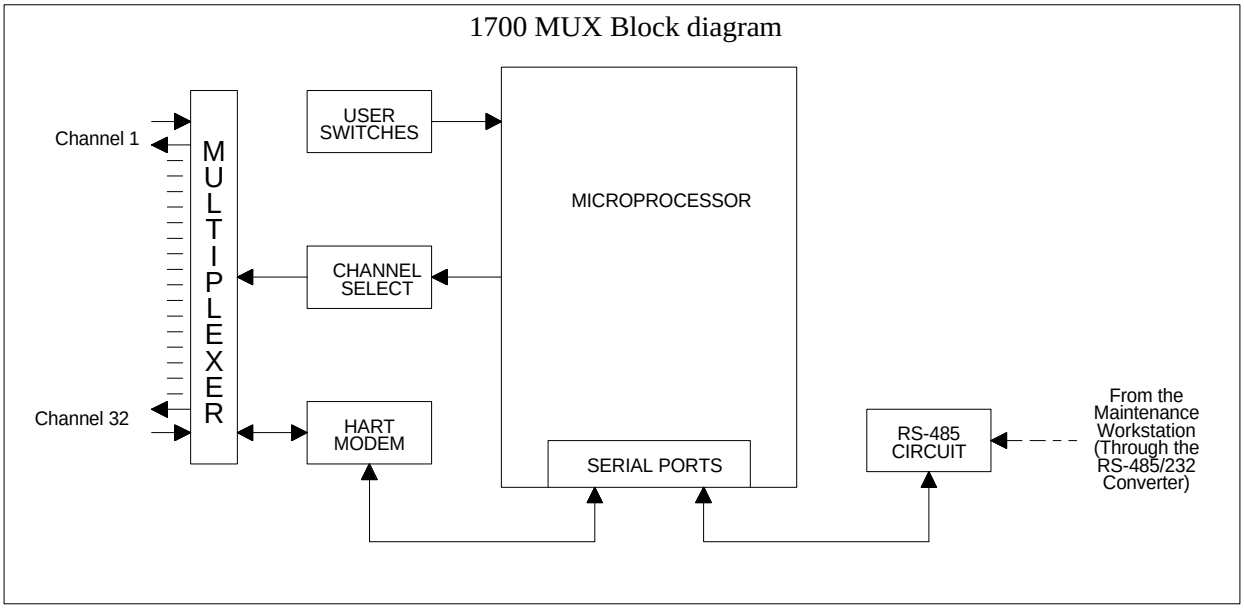


Figure 5

4.1 Multiple Multiplexers

Up to 31 1700 MUXs can be connected on a single RS-485 network to support 992 devices. Multiple 1700 MUXs are connected in daisy-chain form, and redundant terminals are provided for this on each board.

5. Troubleshooting

Due to the modular nature of the HIS system, a communication failure may occur anywhere in the data transfer link from the software to the field device. In order to identify where the loss of communication has occurred, it is important to understand which components are working correctly. Often, some simple checks will save hours of troubleshooting. Some of the most common mistakes are: improper wiring connections, baud rate mismatches, improper network settings, and improper addressing of the 1700 MUX.

5.1 1700 MUX

The LEDs at the front of the 1700 MUX provide a convenient indication to the user that the 1700 MUX is operational. During normal operation, the "Power On" light should be on. The "Fault" light should be off. The "Tx" light may either be off or flashing steadily.

When power to the 1700 MUX is cycled or a "Reset" command is issued, all the lights will come on. Then, the "Power On" light only will come on. For the next 60 to 120 seconds, the "Tx" light will flash three times then pause. During this time, the 1700 MUX is scanning each of the 32 channels. When it is finished, the "Tx" light will either flash steadily or turn off altogether. If you see all of the above occur, the 1700 MUX is operating properly.

In addition, the TEST setting on the option switches can be used to gain confidence that the module is functioning. Follow the procedure below to use this feature:

1. With the power off, set the end switch to the TEST position (ON). The module should not be connected to the RS-485 network, the RS-485 address switches have no effect. If an RS-485 terminal is connected to the module, the BAUD rate switches should be set.
2. Switch power on. The LEDs should light for about 1 second each in sequence (RED, YELLOW, GREEN…).
3. If the LEDs do not flash, there is a fault with the module and it should be returned for replacement.
4. To return to normal operation, remove power to the 1700 MUX and set the TEST switch to the off position. Ensure that the correct BAUD rate is selected and that an RS-485 address is set. Then, re-apply power.

If you suspect the 1700 MUX is not functioning properly, use Table 4 below.

Table 4
1700 MUX LED Indications

Symptom	Cause	Solution
Lights flash sequentially	TEST switch is ON	Switch off the power Put TEST switch OFF Restart the system
No LEDs lit	Power fail or fuse open	Check 24 VDC supply LED and fuse
Only yellow LED lit	Scanning is disabled. If scanning is enabled, then no HART devices were detected by the 1700 MUX	Check wiring continuity
Red LED lit	Self-test fault	Contact Elcon Instruments for further instructions

6. Maintenance

Elcon Instruments apparatus do not require any particular maintenance under normal operating conditions. They are designed to operate trouble-free and with high stability for long periods.

> WARNING! Any repair made by unauthorized personnel may completely invalidate the safety characteristics of the unit and could void all warranties. Repair not made by Elcon Instruments is fully at user's risk and responsibility. In addition, the warranty terms of the unit will be null and void to all effect.

7. Parts List

Table 5 is a representation of the parts on the HPSM that can be replaced by the user. There are no parts in or on the 1700 MUX itself that can be replaced in the field. If any other parts need to be replaced, please contact your nearest Elcon Instruments representative for instructions.

Table 5
Replaceable Parts

Part Number	Description
501300	Supply ID label
502401	Terminal blocks MVSTBW 2.5/3-ST-5.08
507500	Jumper Shunt 0.100”
508112	Fuse 5x20 time-lag, 2 Amp F1
508200	Vertical fuse holder for 3.15 Amp F1

8. Warranty

Elcon offers an extended period of warranty assistance performed at their factory. Each instrument to be repaired will be thoroughly analyzed to locate the cause and mode of possible faults and correlate them with the initial, intermediate, and final testing documentation. This allows Elcon to trace with more accuracy the fault causes, thus obtaining valuable indications, reliability statistics, and qualitative evaluation for the purpose of maintaining the quality and reliability of their products under strict control.

WARRANTY CONDITIONS.
Elcon Instruments certifies that all the instruments of their manufacture are immune from defects or loss of essential quality, and whenever they are apparatus, Elcon also guarantees proper operation. The duration of the warranty period is clearly indicated in the order confirmation and starts from the date of delivery or on-site test (if required). Unless otherwise specified, the warranty is for 12 months from delivery date. The warranty does not cover consumable items.

TERMS - CONDITIONS - WARRANTY LIMITS.

1. Form of report
   The action due to the customer for vices, defects, or loss of quality is subject to the terms of articles 1495, 1497 C.C. (Italian Civil Code). The denunciation of the defect or quality loss must be made by the customer by registered mail, telex, fax, or equivalent written form to be sent to the main office of Elcon Instruments.

2. Limit-burden obligation of the customer to conserve the warranty

a) The warranty is limited to repairing and substitution, FOB Elcon Instruments factory, of the useless parts, for a confirmed defect of materials and/or workmanship, free of charge, and the remaining, shipping, dismounting and mounting expenses (operations that in any case must be done in accordance with the supplier), at the customer's charge. In no case will Elcon Instruments be held responsible for expenses, for loss of profit and/or damage, direct or indirect, that can be incurred by the customer due to a fault or defect of the material.

b) The warranty ends for instruments or materials damaged by:
- Shipment
- Storage not conforming to the instruction manual specifications
- Incorrect installation
- Loss of adequate protection for the type of installation (mechanical, climatic, etc.)
- Incorrect application of power supply voltage
- Erroneous wiring of the power supply line (applied on input or output measuring circuits)

c) The warranty ends for instruments or materials if repaired, modified, or simply tampered with, even if only in part, by personnel not authorized by Elcon Instruments and also ends if used in improper way and/or not conforming with the given instructions.

d) The warranty is valid only if payment has been received from the customer in a timely fashion, as per the original agreement; otherwise it is void.

e) All parts that are subject to normal wear and inevitable deterioration are excluded from this warranty.

f) In case of having to return the instrument to one of the Elcon Instruments authorized labs for repair, the customer shall obtain a written authorization with shipping instructions from Elcon Instruments. Shipment expenses, all the concerned burdens, and the risk of loss or damage of the returned instrument are exclusively born by the customer. The same rules apply also when the instrument needs to be replaced.

g) During the warranty period, the customer will allow any personnel appointed by Elcon Instruments to execute control of the instruments and materials.

h) The customer cannot require cancellation of the contract in reason of vices or defects, but only their elimination or, when they cannot be repaired, the replacement of the instruments, if available on the market. In case the replacement is for any reason impossible, Elcon Instruments has the faculty to offer instruments of the same or equivalent type, quality and efficiency, suitable to the same use. If the customer refuses such offer without justified motivation, he is entitled to reimbursement of the money already paid or a refund of the real incurred expenses.

i) For items subsupplied by Elcon Instruments the standard warranty terms as given by the original manufacturer are applicable.

j) The warranty must be considered for material repaired, substituted on ex works basis.

Such warranty replaces and supersedes any other declared or implicit warranty.

9. Glossary

DCS	Distributed Control System
FSK	Frequency Shift Keying
HART®	Highway Addressable Remote Transducer
HHT	Hand Held Terminal
IS	Intrinsic Safety
MW	Maintenance Workstation
PC	Personal Computer
PLC	Programmable Logic Controller
TB	Termination Board

10. Contact Information

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