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MODELS 485HF25/M25

PLUG-IN

SIGNAL

LEVEL

ADAPTOR

RS-232 to RS-422/485

This Instruction Manual is supplied with the Model 485HF25 and 485HM25 Adaptor to provide the user with sufficient information to utilise the purchased product in a proper and efficient manner. The information contained has been reviewed and is believed to be accurate and reliable, however **Amplicon Liveline Limited** accepts no responsibility for any problems caused by errors or omissions. Specifications and instructions are subject to change without notice.

Model 485H-F25/M25 Instruction Manual Part N° 859 864 04 Issue A2

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Approved for issue by A.S. Gorbald, Operations Director

DECLARATION OF CONFORMITY

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We declare that the product(s) described in this Instruction Manual are manufactured by Amplicon Liveline Limited and perform in conformity with the following standards or standardisation documents:

Electro Magnetic Compatibility (EMC):

EMC Directive 89/336/EEC
LVD Directive 73/23/EEC
CE Directive 93/68/EEC



Jim Hicks, I. Eng, MIEIE
Managing Director
Amplicon Liveline Limited

Model 485HF25 and 485HM25**RS232 to 422/485 Adaptors****LIST OF CONTENTS**

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1. INTRODUCTION

1.1 General Description

The Model 485H-F25/M25 Adaptor is a compact, plug-in unit providing bi-directional conversion of serial data communications signals between the following standards:-

RS-232 ↔ RS-422
RS-232 ↔ RS-485

The Adaptor is equipped with a 25 way D type connector, either female for the 485HF25 or male for the 485HM25 as ordered. Most RS-232 devices are similarly equipped, and when properly configured and powered, the adaptor can be plugged into the appropriate port to convert the transmit and receive signals to RS-422/485 levels.

The unit is supplied factory configured as Data Terminal Equipment (DTE) for the Model 485HF25 (Female) version and as Data Communication Equipment (DCE) for the Model 485HM25 (Male) version. Reconfiguration for other combinations is easily undertaken.

The data conversion process changes only electrical levels and pin-out configuration to the appropriate standards and the adaptor itself is not considered as DTE or DCE. Where these terms are used, they apply to the RS-232 equipment to which the Adaptor is connected.

DC power, applied from an external source, ensures that the RS-422/485 circuits in any valid network can be properly driven when fully loaded.

RS-485 multi-drop operation allows up to 32 devices to be connected in a simple network on a single serial bus. The transmitter has tri-state output and may be disabled to allow reception over the same wire pair. The high impedance state (transmitter disabled) is commanded from an external control signal or from the host computer RTS line.

EMC Considerations

In order to maintain compliance with the EMC directive, 89/336/EEC, it is mandatory that the final system integrator uses good quality screened cables for external connections. It is up to the final system integrator to ensure that compliance with the Directive is maintained. Amplicon Liveline offers a series of good quality screened cables for this purpose. Please contact our sales staff.

1.2 Technical Features

- RS-422 or RS-485 compatible
- Multi-drop capability
- Male or Female connector versions available
- Configurable for DTE or DCE operation
- Single power supply connection. Polarity protected
- Compact and versatile
- CE marked for EMC compliance

1.3 What the Package Contains

CAUTION

Some of the components on the board are susceptible to electrostatic discharge, and proper handling precautions should be observed. As a minimum, an earthed wrist strap must be worn when handling the 485H-F25/M25 Adaptor outside its protective bag.

Full static handling procedures are defined in British Standards Publication BSEN100015/BSEN100015-1:1992.

When removed from the bag, inspect the board for any obvious signs of damage and notify Amplicon if such damage is apparent. Do not plug a damaged board into the host computer. Keep the protective bag for possible future use in transporting the board.

1. The Model 485H-F25/M25 Adaptor board with the plastic case disassembled. The plastic case should not be snapped together until any necessary configuration changes have been made.

Order code for the Model 485HF25 Adaptor is 909 560 63

Order code for the Model 485HM25 Adaptor is 909 560 83

2. This 485 Instruction / Reference manual. Amplicon part number 859 764 04

Any additional accessories (mating connectors, power supply etc.) may be packed separately.

1.4 The Amplicon Warranty Covering the Model 485H-F25/M25 Adaptor

This product is covered by the warranty as detailed in the Terms and Conditions stated in the current domestic or international **Amplicon Liveline** catalogue.

Changes made in accordance with the guidelines given in this manual will not void this warranty unless any damage is a direct consequence of mishandling.

DO NOT MAKE ANY MODIFICATIONS OTHER THAN JUMPER CHANGES TO A PRODUCT THAT IS ON EVALUATION.

1.5 Contacting Amplicon Liveline Limited for Technical Support or Service

The Model 485H-F25/M25 Adaptor is designed and manufactured by Amplicon Liveline Ltd. Support and maintenance are available throughout the life of the product.

1.5.1 Technical Support

Should the Adaptor appear defective, please check the information in this manual to ensure that the product is being correctly applied.

If an application problem persists, please request Technical Support on one of the following numbers:

| | | |
|------------|--|------------------|
| Telephone: | UK | 01273 608 331 |
| | International | +44 1273 608 331 |
| Fax: | UK | 01273 570 215 |
| | International | +44 1273 570 215 |
| Internet | support@amplicon.co.uk www.amplicon.co.uk | |

1.5.2 Repairs

If the Model 485H-F25/M25 Adaptor requires repair then please return the goods enclosing a repair order detailing the nature of the fault. If the meter is still under warranty, there will be no repair charge unless the fault has been caused by misuse.

For traceability when processing returned goods, a Returned Materials Authorisation (RMA) procedure is in operation. **Before returning the goods, please request an individual RMA number** by contacting Amplicon Customer Services by telephone or fax on the above numbers.

Give the reason for the return and, if the goods are still under warranty, the original invoice number and date. Repair turnaround time is normally five working days but the Service Engineers will always try to co-operate if there is a particular problem of time pressure.

Please mark the RMA number on the outside of the packaging to ensure that the package is accepted by the Goods Inwards Department.

Address repairs to:

Customer Services Department
AMPLICON LIVELINE LIMITED
Centenary Industrial Estate
Brighton, East Sussex
BN2 4AW
England

2. INSTALLATION INSTRUCTIONS

2.1 Requirements of Host Equipment

The Model 485H-F25/M25 Adaptor can be plugged into any device with an RS-232 port terminating in a 25 way D type connector (DB-25). If the host device is equipped with a 25 way plug, then the 485HF25 (Female) Adaptor is required, if fitted with a 25 way socket then the 485HM25 (Male) Adaptor is needed.

Some RS-232 interface connectors do not comply with the DB-25 standard. DB-9, DIN and mini-DIN types and other connectors are sometimes used. If the pin connections of the host device interface are known, then enough information is given in this manual to make up a suitable adaptor cable. Where appropriate for the application, a 9 pin version of the 485HF25 Adaptor (Model 485HF9) and an isolated version of the 485HF25 Adaptor (Model 485Fi) are available from Amplicon Liveline Ltd.

2.2 Connections to Model 485H-F25/M25 Adaptor

Connections are made to the Model 485H-F25/M25 Adaptor at each end of the module. The RS-232 connections are automatically made when the Adaptor is plugged into the port, and the RS-422/485 data, control and power connections must be made through a pluggable 8 way screw terminal connector assembly at the free end.

2.2.1 RS-232 Connections on the 25 way D Connector

The connections conform to the RS-232 25 way pinout standard, and are shown in figure 2.1 below. The diagram shows the connector as viewed from the face of the socket/plug mounted on each model of the 485H-F25/M25 Adaptor. The adaptors normally mate with DTE and DCE respectively and the pinouts meet these standards.

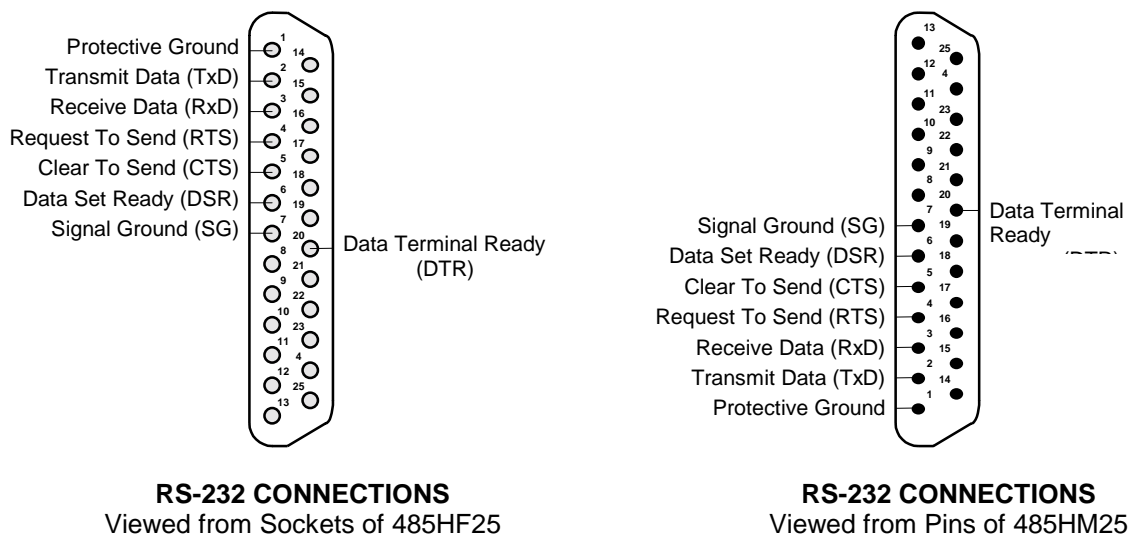


FIGURE 2.1 RS-232 CONNECTIONS

2.2.2 RS-422/485 Connections on 8 way Pluggable Terminal Strip

The DC power input, RS-485 transmission turnaround external control signal and RS-422/485 data signal connections are made via an eight way screw terminal connector. The supplied connector can be unplugged from the Adaptor for ease of making the cables without removing the Adaptor from the port.

The connector pinouts are shown in figure 2.2 below. The diagram shows the connector as viewed from the top face of the Model 485H-F25/M25 Adaptor. The abbreviated function names are printed on the PCB extension below the fixed part of the connector. **Note that for conformance with current standards and ESD requirements, the connection configuration is not identical to all other 485 Adaptors in the Amplicon range.**

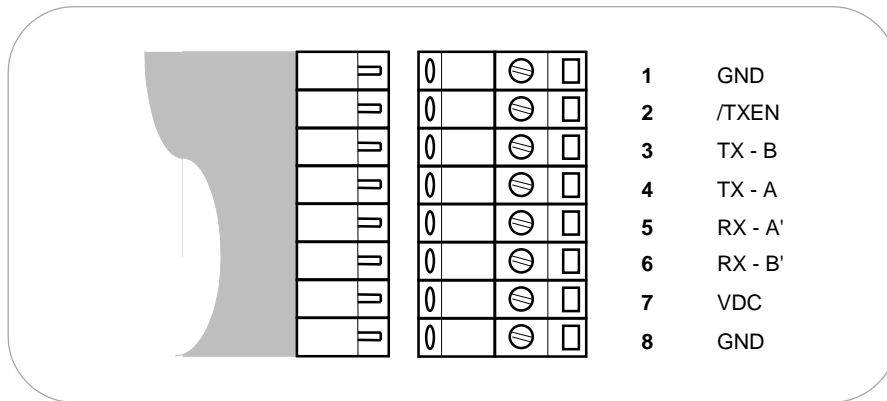


FIGURE 2.2 RS-422/485 CONNECTIONS

2.3 Configuration of Model 485H-F25/M25 Adaptor Options

Configuration of the options is undertaken by jumpers on the component side of the Model 485H-F25/M25 Adaptor printed circuit board. The Adaptor as supplied is set up to suit the majority of applications requiring full duplex operation or half duplex with echo.

For convenience, the plastic case is supplied in two parts and should only be clipped together when any configuration changes have been made. Operational tests can be performed before the case is fitted. If the case halves have been snapped together, they may be parted using a small flat-bladed screwdriver to pop open the case. The technique is shown in figure 2.3 below.

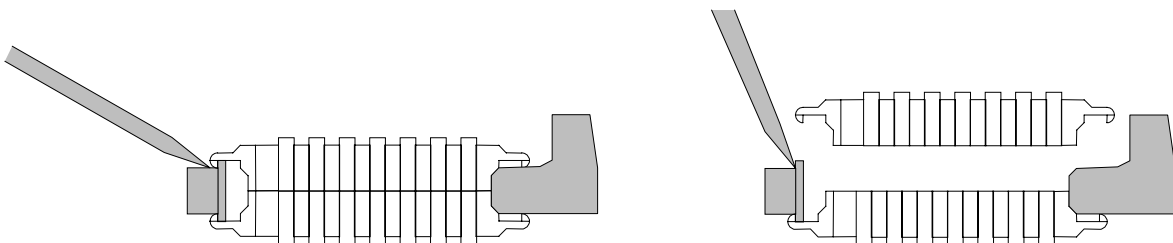


FIGURE 2.3 OPENING THE PLASTIC CASE

The configuration options listed below are available, and the appropriate jumper positions are shown in figure 2.4.

| Jumper | Default Position | Default Function | Alternative Position | Alternative Function |
|----------------------|------------------|--------------------------|----------------------|----------------------|
| Jumper J1 | OUT | /External Tx Enable | IN | RTS Tx Enable |
| Jumper J2 | IN | Rx Terminator in circuit | OUT | Rx Terminator out |
| Jumper J3 | OUT | Receive enable/Echo ON | IN | Half duplex echo OFF |
| MODEL 485HF25 | | | | |
| J4/5 Pair | Vertical | DTE Compatible | Horizontal | DCE Compatible |
| MODEL 485HM25 | | | | |
| J4/5 Pair | Horizontal | DCE Compatible | Vertical | DTE Compatible |

The configuration options are described in more detail in paragraphs 2.4 through 2.8. For many applications, no changes need be made, but if re-configuration is required, locate the jumper position from figure 2.4 which diagrammatically illustrates the component side of the printed circuit board. For safe keeping, jumper J2 may be hung on a single pin if the receiver termination resistor needs to be taken out of circuit.

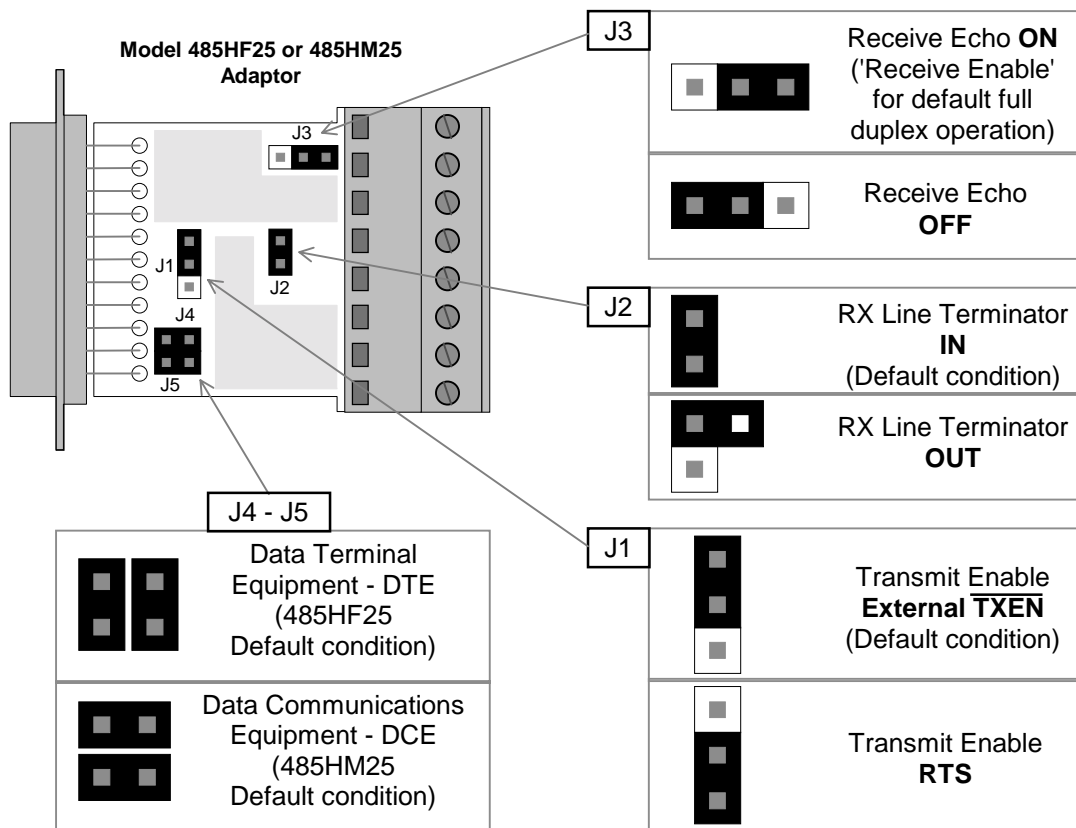


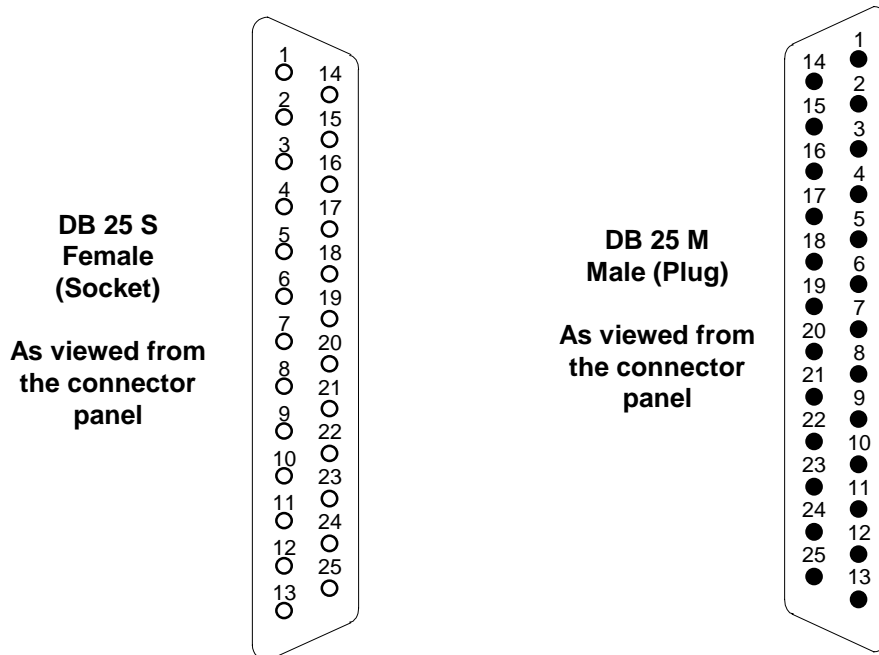
FIGURE 2.4 CONFIGURATION OPTIONS

2.4 DTE or DCE?

The 485H-F25/M25 Adaptor converts the electrical levels of RS-232 signals to the levels specified for RS-422/485 and vice versa. The host device incorporating the RS-232 interface is likely to be a computer, terminal, printer, modem or other instrument. This host RS-232 device will be either Data Terminal Equipment (DTE) or Data Communication Equipment (DCE) as determined by the manufacturer. In order to correctly configure the 485 Adaptor it is necessary to know whether the RS-232 device is DCE or DTE, and this information should be given in the relevant manufacturers' instruction manual. Normally a DTE device is itself equipped with a male connector and a DCE device is equipped with a female connector, but although specified in the RS-232 standard, not all manufacturers comply, and it may be necessary to make a simple test to determine if the device is DCE or DTE.

Power up the unknown equipment, and ensure that nothing is plugged into the 25 way connector of the RS-232 port. Using a multi-meter, first measure the voltage on pin 2 of the connector (male or female) with reference to ground on pin 1 or 7, then measure the voltage on pin 3 in the same way. The pin with the most negative voltage will be the output pin and will identify the device as DCE or DTE. Figure 2.5 shows the RS-232 connections of the host equipment and will help to identify the pins on which the measurements are taken.

- If the most negative voltage is on pin 2, device is DTE
- If the most negative voltage is on pin 3, device is DCE



**FIGURE 2.5
VIEW OF 25 WAY D TYPE MALE AND FEMALE CONNECTORS ON HOST RS-232 DEVICE**

As shipped from the factory, the Model 485HF25 (Female) Adaptor is configured for plugging into a DTE RS-232 device, and the 485HM25 (Male) for DCE. Normally the adaptor will not need to be re-configured, but if a change is needed, refer to jumper group J4 - J5 in figure 2.4. Remove both jumpers and replace them rotated through 90°

2.5 Full Duplex / Half Duplex Operation

The Model 485H-F25/M25 Adaptor can be used in either full duplex (simultaneous transmission and reception of RS422/485 signals over two independent wire pairs) or half duplex (sequential transmission or reception over a single wire pair).

In full duplex operation, a separate transmitter and receiver circuit is employed, and in this mode the transmitter can be left in its enabled state at all times. In half duplex operation, the transmitter output and receiver input wire pairs are connected in parallel, and the transmitter must be disabled by switching to its high impedance state when allowing reception of data over the same serial lines.

The Model 485H-F25/M25 Adaptor is provided with all the data input/output terminals required for full duplex operation. **If half duplex working is required, then the following external and internal configuration changes must be considered.** Also check that the termination resistor, paragraphs 2.8 and 3.3.4, is correctly set for the system in use.

2.5.1 Selection of Full/Half Duplex

In the full duplex position, the serial RS-422/485 signals are transmitted on the wire pair TX - A and TX - B and the incoming signals are received on RX - A' and RX - B'. In half duplex operation, the data signals are both transmitted and received on the two pairs externally wired in parallel.

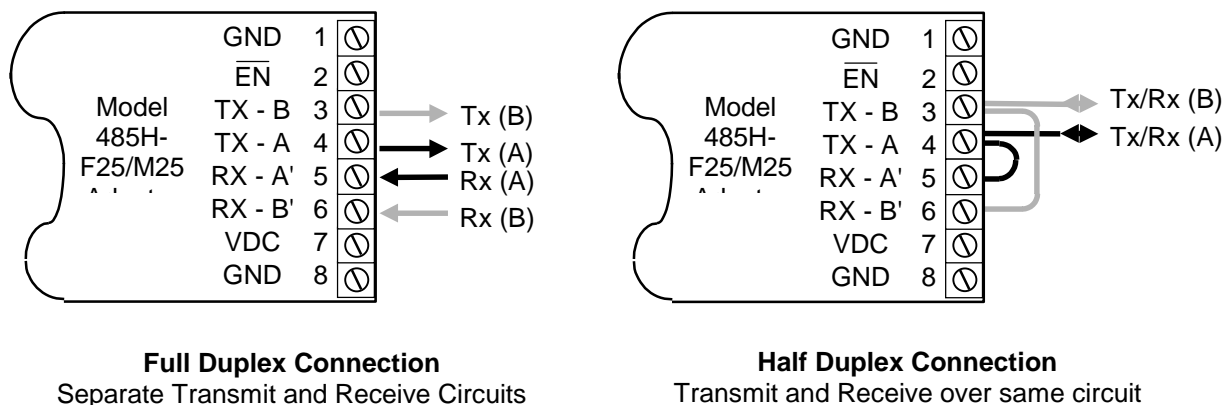


FIGURE 2.6 CONNECTIONS FOR FULL AND HALF DUPLEX OPERATION

2.6 Selection of Transmit Enable Control Signal

In half duplex operation over a single circuit or a multi-drop arrangement, the transmitter must be enabled when the device is ready to transmit, and disabled (tri-state) when the device is ready to receive. Two methods are provided for enabling the transmitter, and the desired method is selected by the jumper J1. (See figure 2.4 for the jumper location).

1. **External $\overline{\text{TXEN}}$.** With the External $\overline{\text{TXEN}}$ (Not Transmit Enable) option selected on J1, the transmit enable is under the control of a TTL level signal applied to terminal 2 ($\overline{\text{EN}}$) of the connector strip. This control signal is active low, and is internally pulled down when no signal is applied. In full duplex or transmit only operation, this control line can be left open-circuit, when the transmitter will be continuously enabled.

In externally controlled half duplex operation, or any other situation where the transmitter requires external control, the signal applied to terminal 2 for enabling or disabling the transmitter must not exceed the following levels:-

| | | |
|-------------------------------------|------------------|--------------------|
| ENABLE TRANSMITTER '0' (Active Low) | Input low | > - 30 V < +0.8 V |
| DISABLE TRANSMITTER '1' | Input high (V) | > +2.4 V < +15.0 V |
| | Input resistance | ~5 kΩ |

Figure 2.7 shows how the external control connection is made. Note that the power supply voltage VDC applied to pin 7 is in the range for disabling the transmitter, and can be used in conjunction with switch or relay contacts to turn transmission around.

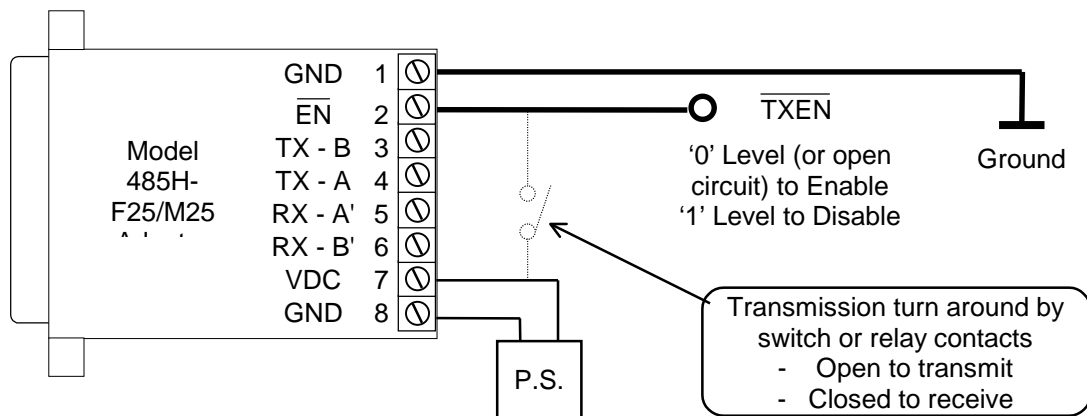


FIGURE 2.7 EXTERNAL TRANSMITTER ENABLE CONNECTIONS

2. **RTS Transmit Enable.** The transmitter can alternatively be enabled under control of the RTS (Request To Send) line of the RS-232 host DTE device. See J1 in figure 2.4 for the appropriate jumper patching. No connection must be made to external /TXEN (Pin 2) when RTS is controlling the transmission turnaround.

In normal RS-232 DTE operation, RTS is raised to its ON condition when the device is ready to commence transmission. In many circumstances, the use of RTS provides a simple means of enabling the transmitter. However, check overall system timing before using this control method.

Further information on half duplex and multi-drop operation is given in the applications section of this manual.

2.7 Selection of Local Echo On/Off in Half Duplex Operation

The factory default configuration of jumper J3 causes the transmitted data to be echoed to the receiver in half duplex operation. If this echo is not required, the jumper must be changed over to link the centre and left pins. This change ensures that the RS-485 receiver is enabled/disabled in opposite phase to the transmitter.

For full duplex operation, the jumper J3 must be in its default (right-most position as viewed in fig. 2.4) condition for the receiver to be continuously enabled.

2.8 Transmission Line Termination

In RS-422 or RS-485 applications, the two wire transmission lines must be properly terminated, and a single resistor across the receiver input pair normally provides adequate termination.

The Model 485H-F25/M25 Adaptor is equipped with a terminator resistor for the receiver input pair, and this resistor is connected into circuit by the J2 jumper on the printed circuit board. See figure 2.4. Factory setting is with the receiver input terminator in circuit, but it can be disconnected from the circuit by removing the jumper. Hang the jumper on a single pin for safe keeping. Disconnection of the termination resistor is required in some multi-drop applications.

See the applications section of this manual for a discussion of bus termination.

2.8.1 Network Biasing Resistors

In some instances, particularly in RS-485 multi-drop operation, noise may be detected at the receiver. In the multi-drop configuration, there can be brief periods when no transmitter is enabled, and the network is therefore allowed to float. The Model 485H-F25/M25 Adaptor is protected against this condition, but other devices on the network may be susceptible to noise and are liable to float to a potential that is detected as an input. The programmer can sometimes overcome this situation by ensuring that the communications protocol flushes the input buffer until the beginning of the message flag is found.

If this problem is encountered and a software solution is not viable, two extra resistors can be added externally to the 485H-F25/M25 transceiver at one end of the bus, so that the network is biased to about 1 to 2 volt when all transmitters are disabled. The internal termination resistor must be kept in circuit. The arrangement is shown in figure 2.8.

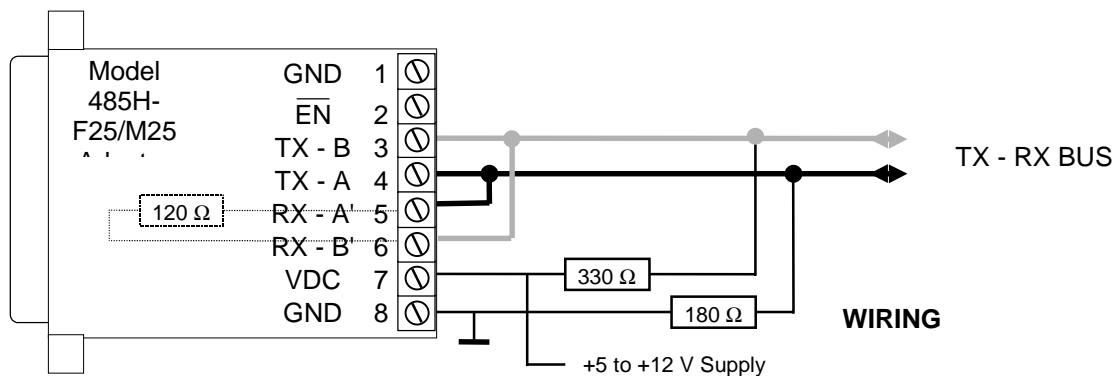


FIGURE 2.8 NETWORK BIASING RESISTORS

2.9 Power Requirements

The Model 485H-F25/M25 Adaptor must be powered from an external power supply providing a positive output of between +5.0 VDC (minimum) and +13.0 VDC. This auxiliary power supply unit should be capable of sourcing at least 100 mA for the 485 Adaptor that it supplies. Amplicon Mains adaptors meet these requirements and the U.K. plug-in version is available under order code 919 135 69, International wired-in version is order code 919 448 69. See paragraph 2.9.1 for information on connecting these power supplies to the Model 485H-F25/M25 terminals.

The 485H-F25/M25 Adaptor is fitted with an eight way pluggable terminal strip at its free end, and the power supply should be connected to terminals 7 and 8. Terminal 8 is Ground or negative and terminal 7 is the positive supply. OBSERVE POLARITY when powering the adaptor. If the polarity is incorrect, the 485H-F25/M25 Adaptor will not operate, but is protected against damage. A wiring diagram for applying power to a Model 485H-F25/M25 Adaptor is

shown in figure 2.9 with the connections to multiple, parallel powered Adaptors are shown dashed.

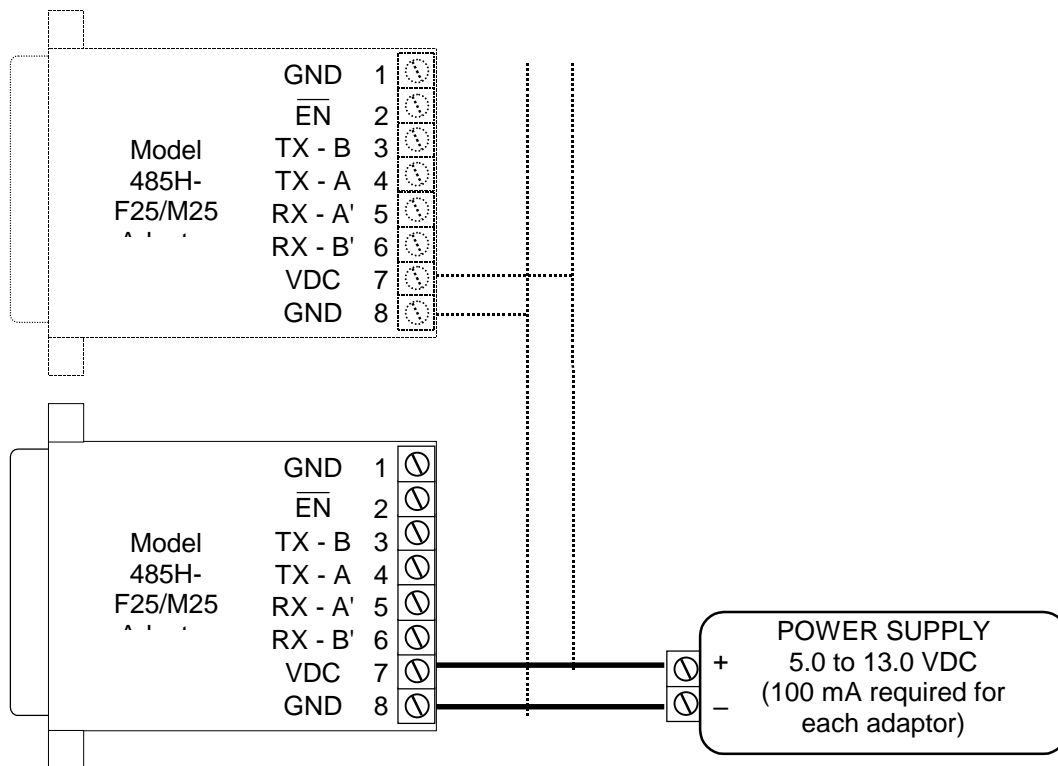


FIGURE 2.9 POWER SUPPLY CONNECTIONS TO MODEL 485H-F25/M25 ADAPTOR(S)

2.9.1 Connecting the Amplicon Mains Adaptor

The optional mains adaptor plugs directly into a 3 pin, 13 A mains socket (U.K. version), or must be fitted with a suitable plug (International version). The mains supply voltage must be 230 VAC $\pm 10\%$, 50 Hz. The DC output is by a two wire cable approximately 2 m in length. This cable is terminated in a moulded connector which must be cut off and discarded. The two wires can then be parted and stripped back about 6 mm. The black wire is negative and goes to terminal 8 (GND) of the 485H-F25/M25 Adaptor, and the black wire with a white stripe is positive and goes to terminal 7 (VDC). Section 5.3 gives the Amplicon order codes for the above adaptors.

When multiple 485 Adaptors are fed from a single supply as in figure 2.10, the grounds of all the devices on the RS-422/485 bus will be connected together through the common negative supply line and the internal ground connections of the Adaptors.

2.10 Software Installation

Software is not supplied with the 485H-F25/M25 Adaptor, but a choice of suitable software packages is available from Amplicon Liveline Ltd. to allow easy integration of serial communications into the user's application.

The 485H-F25/M25 Adaptor connected via an existing RS-232 port will operate in conjunction with many commercially available communications and data acquisition packages that support RS-232, RS-422 or RS-485 serial operations. The software should be installed according to the supplier's instructions, and due note should be taken of the required settings for the communications channels, and the communications circuit configurations set accordingly.

The following software limitations should be remembered when allocating COM channels:-

MS-DOS 3.2 and below provides support for the first two serial ports only, COM1 and COM2.

MS-DOS 3.3 and above supports COM1, COM2, COM3 and COM4.

Other operating systems allow the use of more than two ports. Check the instructions.

Most BASIC language interpreters/compiler only support COM1 and COM2.

Communications support toolkits such as Amplicon 'COMBIOS for DOS' and 'COMBIOS for Windows' allow add-on serial ports to several different language compilers.

2.11 Installation Testing

Many applications packages include a self test feature, and when the hardware and software have been satisfactorily installed, any such test should be performed to check correct operation.

If no self test is available, or a problem occurs, see the later section 4, 'TESTING AND TROUBLESHOOTING'.

3. APPLICATION INFORMATION

As previously noted, many applications packages are designed to support data transfer over the RS422 or RS485 standard serial communications ports. When set up as specified, the interface will be transparent to the user. However, for special applications, particularly when use of the RS-485 interface is required, the following notes will be helpful.

3.1 Applicable Standards

The prefix 'RS' signifies Recommended Standard, and the three interface types, RS-232, RS-422 and RS-485, are all well defined in the appropriate standards publications. The functions and features of the data interfaces presented by the Model 485H-F25/M25 Adaptor generally conform to normal industry practice employing subsets of the full standards.

The RS-232 serial interface standard is now at revision E and its full title is EIA (Electronic Industries Association) TIA RS-232-E, *"Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Data Interchange"*. Similar European standards CCITT V.24 and V.28 define an interface which is operationally compatible with RS-232.

The RS-232 connection of the Model 485H-F25/M25 Adaptor can be configured as DTE (Data Terminal Equipment) or DCE (Data Communications Equipment) and the Adaptor is available with a male or female connector. The current RS-232-E standard specifies the 25 way male D type connector for DTE, and therefore requires a 485 (Female) Adaptor. Earlier revisions of the RS-232 standard did not specify the connector type.

The full 25 connector pins are not required to support the common functions of RS-232 as used by the Model 485 Adaptor, and IBM and other manufacturers frequently adopt a 9 way D type connector that provides all the necessary functionality. This 9 way connector is now defined in EIA/TIA-574 Recommended Standard. Conversion cables or adaptors such as the Amplicon PC-AT Serial Port Adaptor 909 245 77 are available which can be used with the Model 485 Adaptors. Paragraph 3.2.2 gives the connection details for making up a suitable converter.

The RS-422 interface is defined in the EIA standard RS-422-A, *"Electrical Characteristics of Balanced Voltage Digital Interface Circuits"*.

As stated, this standard defines the electrical characteristics but does not specify a connector type or pin-out configuration. The Model 485H-F25/M25 Adaptor meets the RS-422 standard electrical specification with communication via an 8 way terminal strip connector wired as shown in the installation diagrams.

The RS-485 specification is also published as an EIA/TIA standard and is closely allied to the RS-422. The 485 Adaptor meets the requirements for data signals as laid down in the standard.

3.2 RS-232 Application Notes

RS-232 was approved as a standard interface in 1969. Before and since that time, this interface in its various revisions has been very popular despite its many shortcomings and usage outside of its intended role. Most small computers now have an RS-232 interface as standard, or easily added, and many peripherals and instruments support this serial interface, but not all in the same way. Hence the application of an RS-232 connection needs careful study of the equipment manufacturers connections and methods before the Model 485 Adaptor is installed. However RS-232 lines are quite safe if wrongly connected, so the experimental use of a break-out box or 'hit and miss' methods of establishing communication can be employed.

3.2.1 Electrical Levels

When checking out serial communications circuits, it is useful to know what signal levels to expect. The specified voltage levels of RS-232 data and control signals are summarised in the following table:-

| | | |
|-----------------------------|-----------|-----------|
| Interchange Voltage | -3 to -15 | +3 to +15 |
| Binary State | 1 | 0 |
| Data Signal (TXD) | Marking | Spacing |
| Control Function (RTS, DTR) | OFF | ON |

Signal Ground is at 0 volts, and the region between -3 and +3 volts is the transition region.

The Model 485H-F25/M25 Adaptor will normally be used in close proximity to the RS-232 port, but in a case where it is not close, the following limits apply. The electrical levels at which RS-232 operates limit the maximum data rate to about 20 kilobaud (sometimes used up to 115 kBd) and the maximum cable length between transmitter and associated receiver to about 15 m (50 ft) at the lower rates.

3.2.2 9/25 way Adaptors

The wiring list in figure 3.1 shows the necessary connections to adapt a 9 way RS-232 port to a 25 way RS-232 port, or vice versa. Due note should be taken of the gender of the mating connector, and a gender change can be incorporated in the adaptor if required.

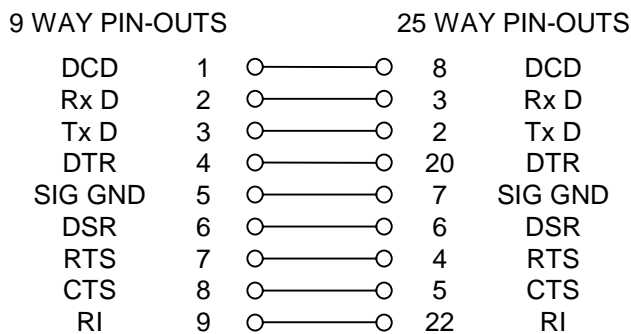


FIGURE 3.1 DTE ADAPTOR - 9 Way to 25 Way

3.3 RS-422/485 Application Notes

RS-422 and RS-485 have very similar characteristics, with RS-485 being compatible with, and offering all the advantages of RS-422 plus some additional capability. RS-422 pre-dated RS-485 as a standard, but RS-485 is now more popular and used in new system design. For the 485H-F25/M25 Adaptor, the on board circuitry for the two modes is identical, the application deciding the mode of interface operation.

3.3.1 RS-422/485 Signalling Sense

The RS-422 and RS-485 standards define the polarity of the signalling lines as follows, and the Model 485H-F25/M25 is in accordance with these specifications.

"The signalling sense of the voltages appearing across the interconnecting cable is defined as follows:

- a. The A terminal of the generator shall be negative with respect to the B terminal for a binary 1 (MARK or OFF) state
- b. The A terminal of the generator shall be positive with respect to the B terminal for a binary 0 (SPACE or ON) state"

3.3.2 RS-422/485 Parameters

The following table in figure 3.2 summarises the principal parameters of the RS-422-B and RS-485 standards, and shows RS-232 for comparison.

| EIA STANDARD | RS-232 | RS-422-B | RS-485 |
|---|-------------------------|------------------------|--------------------------------|
| Mode of Operation | Single ended | Differential | Differential |
| Number of Drivers and Receivers on line | 1 Driver 1 Receiver | 1 Driver 1 Receiver | 32 Drivers 32 Receivers |
| Max. Cable Length | 15 m | 1200 m | 1200 m |
| Max. Data Rate | 20 kBd | 10 MBd | 10 MBd |
| Max. Common Mode | N/A | +7 V, -7 V | +12 V, -7 V |
| Driver Voltage | ±5 V to ±15 V | ±2 V min | ±1.5 V min |
| Driver Load | 3 kΩ to 7 kΩ | 100 Ω min | 60 Ω min |
| Driver Slew rate | 30 V/μs | N/A | N/A |
| Driver Output Short Circuit Limit | 500 mA to Vcc or Ground | 150 mA to Ground | 150 mA to Gnd 250 mA to Vcc |
| Receiver Input Resistance | 3 kΩ to 7 kΩ | 4 kΩ | 12 kΩ |
| Receiver Sensitivity | ±3 V | ±200 mV | ±200 mV |
| Receiver Hysteresis | 1.15 V | 50 mV | 50 mV |

FIGURE 3.2 STANDARD RS-232/422/485 PARAMETERS

3.3.3 CABLING OF RS-422/485 BUS

RS-232 data transmission rates are specified up to 20 kBd but are sometimes as high as 115 kBd. The Model 485H-F25/M25 Adaptor can therefore be used up to 115 kBd and the maximum RS-422/485 cable length of 1200 m will apply at all usable data rates.

RS-422/485 employs a differential method of signal transmission, and each bus cable has to be a wire pair, preferably twisted and screened to keep induced noise to a minimum. The bus distribution cable is effectively a transmission line, and appropriate techniques should be used for installation of the cables. In a multi-drop environment, the cable should be 'looped through' each device, or if a spur is necessary, the spur length should be kept to a minimum.

If screened cable is used, some thought must be given to the connection of the screen. This screen should not normally be used as a ground return for non-isolated devices and it is safest to only connect the screen at a single point to the ground of one device.

The voltage between the grounds of the various devices must not cause the common mode voltage rating of any device on the bus to be exceeded.

3.3.4 Multi-drop Applications

RS-422 can provide limited multi-drop capability, using two twisted wire pairs in a broadcast mode. One wire pair connects one transmitter to multiple receivers, but if duplex operation is required, only one receiving station can answer back. See figure 3.3.

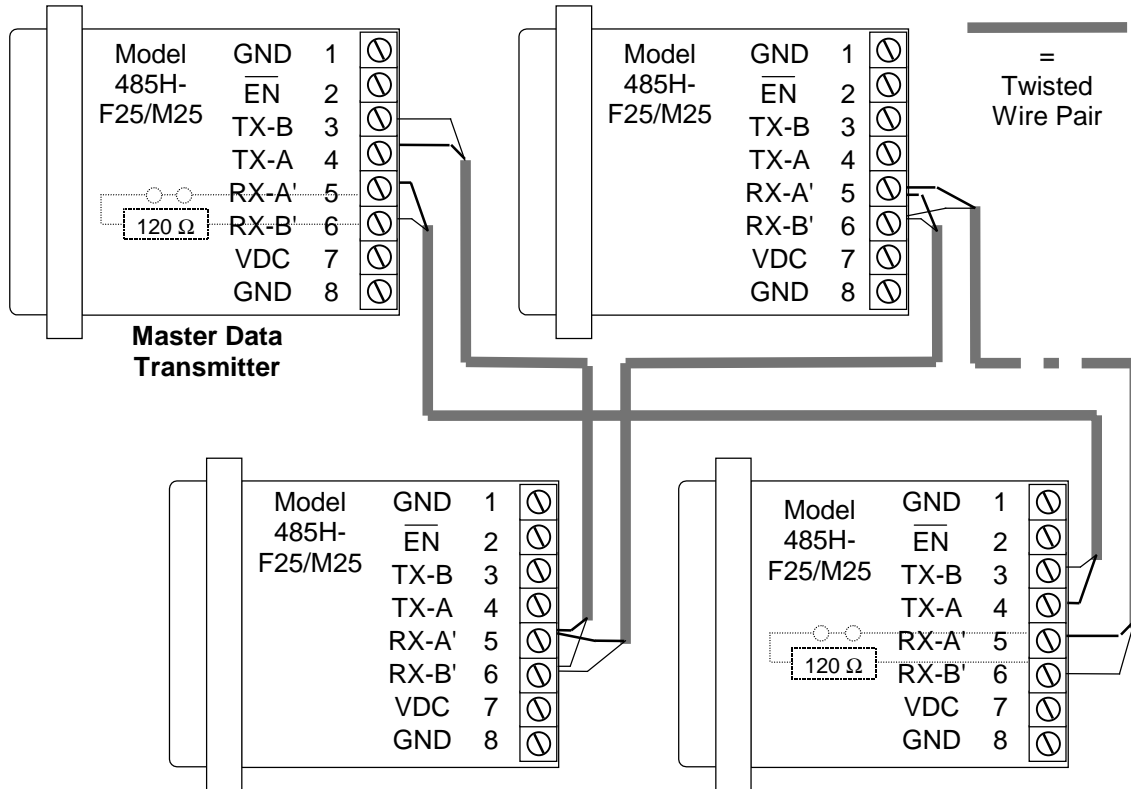


FIGURE 3.3 RS-422 CONNECTED IN BROADCAST MODE

RS-485 allows multiple (up to 32) transmitters and receivers to be connected in half duplex on a single twisted wire pair for 'party line' type of communications. See figure 3.4. A method must be used to stop more than one transmitter being on the line at any time, ensuring that all other transmitters are in a high impedance state, although the circuit design is such that no damage will be done to the transceivers if several transmitters are turned on together. In a multiple RS-485 transmitter installation, the application program controls the data communication turnaround and the selection of the bus 'talker'.

Two common ways of providing program control are the 'Master/Slave' and 'Token Ring' methods. The 'Master/Slave' method designates one device on the network as Master, and this device supervises all transmissions by communicating with each of the Slaves in turn and offering it a transmission slot. In token ring operation, each device knows its ID neighbour and only talks directly to this next device. Thus communication only occurs between adjacent pairs of devices and this makes for a flexible network but can be a more difficult method to implement.

The Model 485H-F25/M25 Adaptor provides a method of communication turnaround by enabling the 'ON' transmitter using an external control signal or RTS from the RS-232 port. Default condition of the Model 485H-F25/M25 Adaptor enables the transmitter, so that for full duplex operation of RS-422/485 no control signal is required.

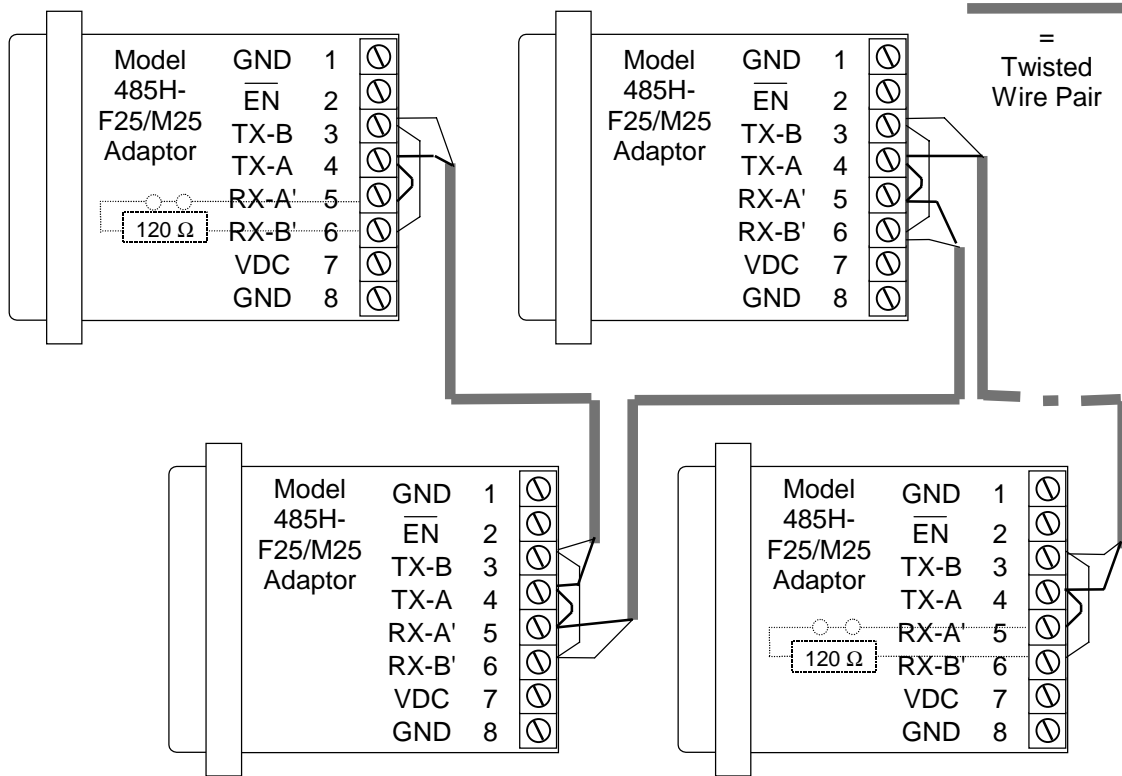


FIGURE 3.4 RS-485 CONNECTED IN MULTI-DROP, HALF DUPLEX MODE

3.3.5 Bus Termination

For proper operation of the RS-422/485 bus in full or half duplex, multi-drop or point to point communication, it is recommended that termination is applied to the receiver end of the data lines.

The simplest form of termination is line to line with typically a 120 Ω resistor across the differential input, and this terminator is available on the Model 485H-F25/M25 Adaptor, selectable by J2.

In a multi-drop system, the terminator resistor is only required at the device receiver located at the far end of the cable. If this is in half duplex operation, then both ends of the bus cable are equipped with receivers (transceivers) so termination is necessary at both ends. Although the 485H-F25/M25 Adaptor will drive loads as low as 27 Ω , in general, RS-485 transmitter circuits are specified as being capable of driving a minimum load resistance of 60 Ω , so no more than two terminator resistors should be connected in parallel to any one bus.

4. TESTING AND TROUBLESHOOTING

4.1 Basic Testing and Fault Isolation

If the installation instructions have been correctly followed, and the serial communications port is being used in conjunction with a proven software driver, then it is unlikely that any problems will be experienced in establishing communications through the serial interface.

When difficulties do occur, the following notes may be helpful in isolating the problem area.

4.1.1 Testing with the Application Software

Before testing, ensure that the Model 485 Adaptor is properly configured for the application. Use the test mode of the application program, and if a problem occurs, it is often possible to test the system using the looped back RS-232 port without the Model 485H-F25/M25 Adaptor. This test will identify that a problem is in the adaptor, its configuration or use.

4.1.2 Loop-back Testing Using a Simple BASIC Program

The Model 485H-F25/M25 Adaptor can be tested in isolation of external influences such as the signal cables, other devices and the applications program by performing the following loop-back test. It is necessary for the Adaptor to be plugged into the host PC and the terminals linked as shown in figure 11. A copy of a BASIC interpreter such as QuickBASIC or GWBASIC will be required to run the 4 line BASIC program given below.

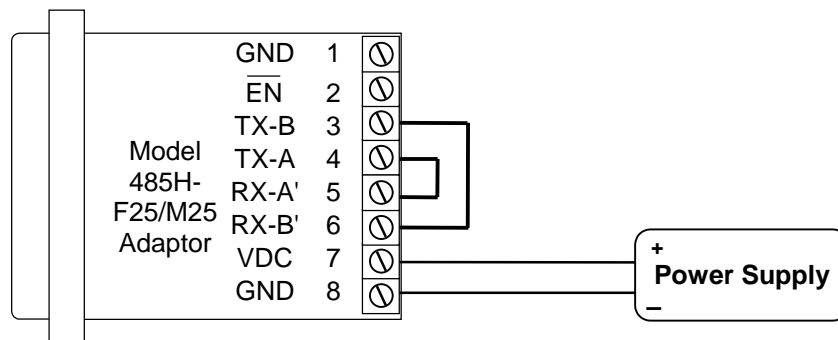


FIGURE 4.1 TERMINAL LINKS FOR LOOP-BACK TEST

The base address of the channel under test should be set to 3F8 (COM1) and the channel interrupt to IRQ4. The test can also be undertaken at 2F8 (COM2) and IRQ3 by changing the first line of the program accordingly.

To test the RS-422/485 port, the following 485 Adaptor configuration settings must also be checked. (See figure 2.4). The settings are the default conditions for the 485HF25 adaptor.

| | | | |
|-----------|----------------------------|-------------|-----------------------|
| J1 | External | J2 | Terminator IN |
| J3 | Echo ON (Rx Enable) | J4/5 | DTE Compatible |

The test sends the message "Loop-back test passed" from the RS-422/485 port and reads it back into the LB\$ variable. The message is then printed once to the screen. This test encompasses proper operation of both the RS-232 interface and the RS-422/485 data lines.

```
10 OPEN "COM1:1200,N,8,1,RS,CS,DS,CD" AS #1
20 PRINT #1,"Loop-back test passed"
30 LB$=INPUT$( ( 21) ,#1)
40 PRINT LB$
```

The parameters in line 10 can be changed as required to perform the test with different baud rates or other communications parameters.

If tests with the applications software or other loop-back tests indicate that the 485 Adaptor is working properly, then the following should be investigated.

Communication circuits. For a communications circuit to operate correctly, both ends of the circuit, and the interconnecting cables must be serviceable and the correct connections made. The vagaries of RS-232, RS-422 and RS-485 implementation often cause problems in making the proper connections, and the manufacturers instructions for the equipment at each end should be carefully checked.

Hardware handshaking control signals. If the communication is operating under a software handshaking protocol (X-ON, X-OFF etc.) then only the transmitted and received data lines need to be connected. If the application requires hardware handshaking by the use of control lines CTS, RTS, etc., the program is likely to hang.

Polarity of RS-422/485 differential data lines. Not all suppliers use the same convention for the polarity of the differential data lines. The Model 485 Adaptor lines are labelled A and B for the transmitter and A' and B' for the receiver as defined in the RS-422/485 specification. If the other device is labelled differently, then:-

A is normally connected to **A** or **A'** or **Y** or **High** or **+**
B is normally connected to **B** or **B'** or **Z** or **Low** or **-**

If all devices are not so labelled and the polarity is not evident, or if a problem is suspected in this area, then some experimentation may be necessary. No damage can be done to the interface hardware by reversing polarity.

Termination of Data and Control Lines. The differential data lines must be properly terminated as described above.

Common Mode Voltages. If peak common mode voltages exceed those specified for RS-422/485 communications, data corruption will occur. An isolated version of the 485 Adaptor (Model 485Fi) is available from Amplicon Liveline to break the ground loop and eliminate this problem.

5. TECHNICAL INFORMATION

5.1 Technical Specification

The technical characteristics of the Model 485H-F25/M25 Adaptor are in accordance with the following electrical and physical specifications. **Except where otherwise noted, all specifications are typical at 25° C**

5.1.1 Electrical Specification

| | |
|------------------------------------|---|
| Supply Voltage | +5 to +13 VDC from external power supply. |
| Supply Current | <100 mA including current drawn by output loads |
| RS-232 High signal input | +2.4 to +30 V |
| RS-232 Low signal input | -30 to +0.8 V |
| RS-232 Input Resistance | 5 kΩ typical |
| RS-232 High signal output | +9 V typical |
| RS-232 Low signal output | -9 V typical |
| RS-232 Output Resistance | 300 Ω typical |
| RS-232 Connector fitted to Adaptor | |
| 485HF25 Adaptor | 25 way D type socket |
| 485HM25 Adaptor | 25 way D type plug |
| RS-422/485 Input sensitivity | 0.2 V |
| RS-422/485 Input hysteresis | 70 mV typical |
| RS-422/485 Output drive | 1.5 V minimum, fully loaded |
| RS-422/485 Output load | 27 Ω minimum |
| RS-485 Tx enable | -30 V to +0.8 V |
| RS-485 Tx disable | +2.4 V to +30 V |
| Maximum Data Rate | 1 MBd |
| TxEN Input Resistance | 5 kΩ typical |
| RS-422/485 Connector | 8 way screw terminal strip |

5.1.2 Physical Specification

| | <u>Module with connector</u> | <u>Packed</u> |
|-------------------|------------------------------------|---------------------------------|
| Size | 67 x 43 x 20 mm | 215 x180 x 80 mm |
| Weight | 60 gm | 250 gm |
| Temperature Range | <u>Operating</u> 0° C to +60° C | <u>Storage</u> -20 to +70° C |

5.2 Optional Accessories

5.2.1 U.K. Mains Adaptor Power Supply

| Amplicon Order Code | Description | Function |
|----------------------------|--------------------|--|
| 919 135 69 | Plug-in adaptor | Provides +9 VDC (nominal) at 200 mA to power one or two Model 485 Adaptors. Mains operated 230/240 VAC. Integral 3 pin, 13 A, UK style plug. Two wire output cable of 2 m length. Moulded connector to be removed for screw terminal connection to 485H-F25/M25 Adaptor. Wire with white stripe is positive, see paragraph 2.4.1 |

The U.K. Mains Adaptor complies with the requirements of British Standard BS415

5.2.2 International Mains Adaptor Power Supply

| | | |
|------------|------------------|--|
| 919 448 69 | Wired-in adaptor | Provides +9 VDC (nominal) at 200 mA to power one or two Model 485 Adaptors. Mains operated 220/230 VAC. Two wire (Brown - live, blue - neutral), 1.5 m length mains input cable. Two wire output cable of 2 m length. Moulded power connector to be removed for screw terminal connection to 485H-F25/M25 Adaptor. Wire with white stripe is positive, see paragraph 2.4.1 |
|------------|------------------|--|

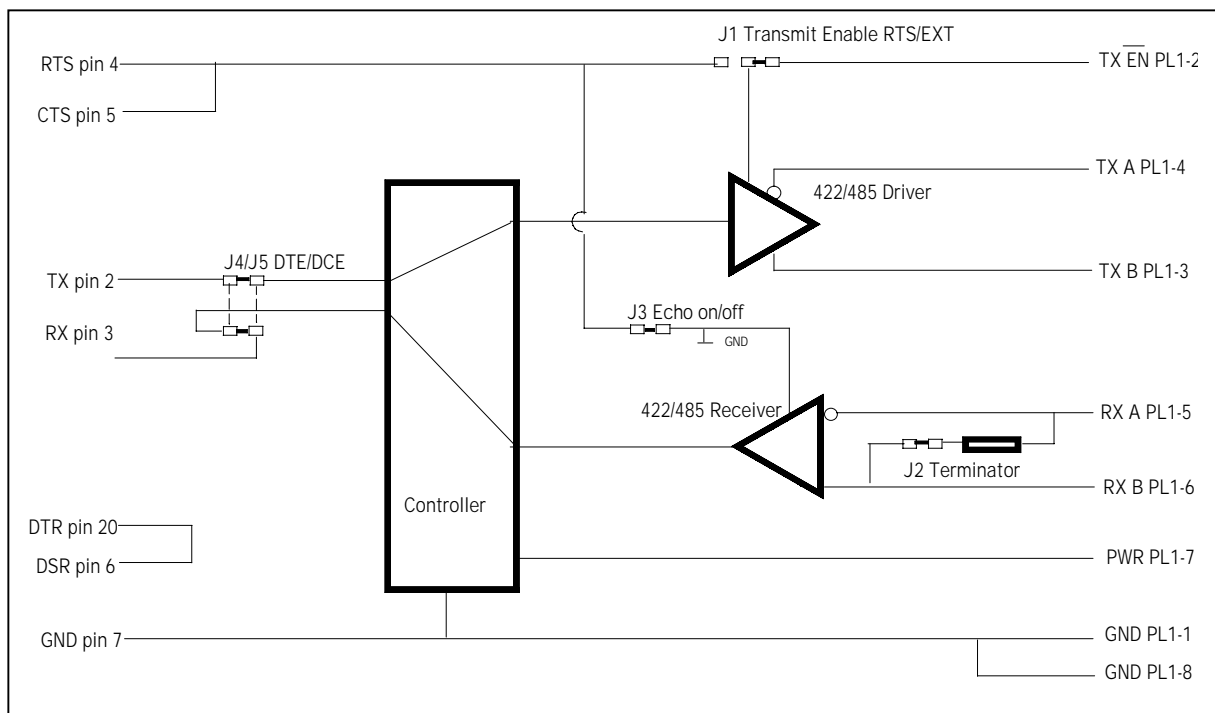


FIGURE 5.1 MODEL 485HF25 AND 485HM25 CIRCUIT SCHEMATIC DIAGRAMS