



**F500 Elite.**

**FIELDBUS ADAPTER.**

**T500 Elite to DeviceNet  
communications.**

**(Software Version 2.0.2.162)**

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# **F500 FIELDBUS ADAPTER.**

## **INTRODUCTION**

This version of the F500 Elite Fieldbus adapter had been designed to work as a T500 Elite communications gateway and has been designed specifically to allow the connection of a T500 control unit running software version 3.0.0 and above, to be networked through their own built in communications system. The network data can then be passed through the Fieldbus adapter to a DeviceNet master. The communications control unit is housed in a self-contained wall-mounting enclosure, and will operate from 115v to 230v AC or from 12v to 24v DC.

## **1. SPECIFICATIONS**

### **1.1 The Control Unit**

A plastic enclosure houses the electronics and terminal connectors. The unit contains a printed circuit board to accommodate power supply circuitry, microprocessor, Fieldbus card and terminals. The design is capable of accommodating 8 of the most common Fieldbus interfaces.

Electrical Supply	–	115 to 230VAC +/- 10% 50/60Hz
	-	12 to 24VDC +/- 10%
Power Consumption	-	10VA/10 WATTS
Terminals	-	Power 4mm <sup>2</sup> 14 AWG max
	-	Communications, as appropriate to the Fieldbus module.
Protection	-	NEMA12,IP55,Class II DIVI,E,F,G
Height	-	9.7", 246mm
Width	-	7.4", 188mm
Depth	-	4", 102mm
Fixing Centres	-	8.75" high x 4" wide, 222mm x 102mm
Cable Entry	-	2 Holes 1 1/8" DIA, 28mm, 3/4" CONDUIT
Weight	-	3lbs, 1.3Kg

## 2. INSTALLATION INSTRUCTIONS

The Control Unit

The Control Unit box should be installed in a suitable control or starter switch room. The box should have sufficient space to open the lid for wiring.



**The Control Unit is susceptible to static voltage. Connection of a clean ground to terminal 29 is essential for optimum performance. Prior to this connection, static handling precautions should be taken.**

## 3 ELECTRICAL WIRING

Refer to Drawings A, B, C & D

When installing the equipment in an area which is likely to be hazardous from Ignitable Dusts, use liquid tight conduit and fittings and follow all local codes.

## 4 OPERATING INSTRUCTIONS

The Fieldbus Adapter is a self contained unit and there are no user configurable options with the exception of the DeviceNet baud rate and MAC address. The adapter is equipped with two communications ports; RS485 and DeviceNet and is supplied preconfigured for 125K baud and MAC address 1.

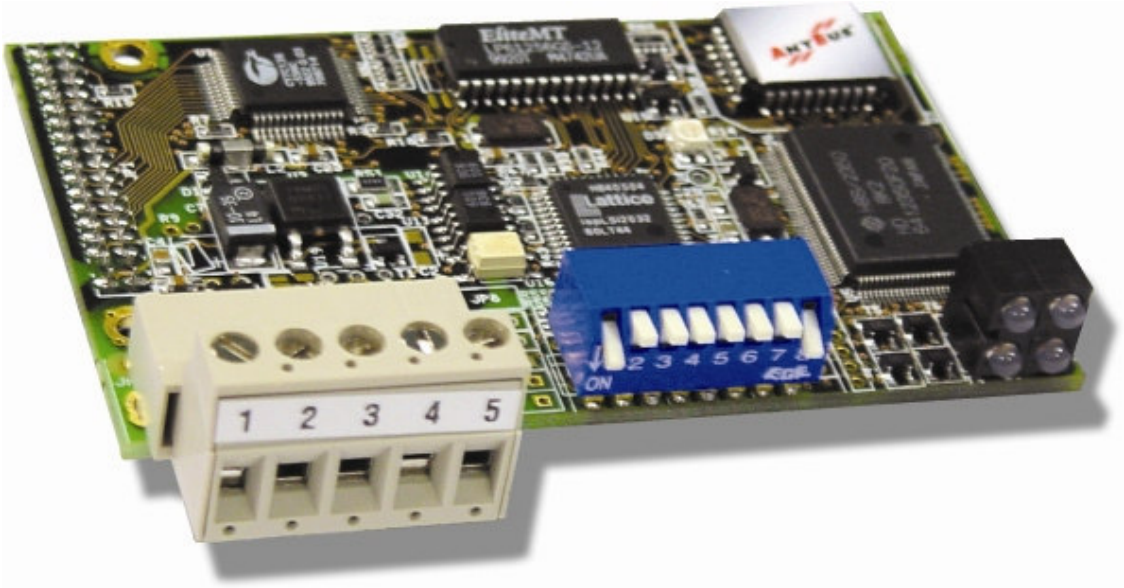
The RS485 port is a four wire; twin twisted pair half duplex serial port and has been specifically configured to work with the T500. You should not connect any other devices to this port

The configuration switch shown in the picture on page 5 and allows selection of the baud rate and the units MAC address. The switches are numbered left to right 1 to 8. The switch is OFF when in the UP position and ON when in the DOWN position.

The configuration is as follows.

Switch 1 & 2	
Switch 1 OFF + Switch 2 OFF	= 125K Baud
Switch 1 ON + Switch 2 OFF	= 250K Baud
Switch 1 OFF + Switch 2 ON	= 500K Baud
Switch 1 ON + Switch 2 ON	= Reserved

Switch 3 to 8 represents the MAC address settings. Switch 3 is the Most Significant Bit of the address and switch 8 is the Least Significant Bit of the address; refer to APPENDIX A for a full list of address settings.



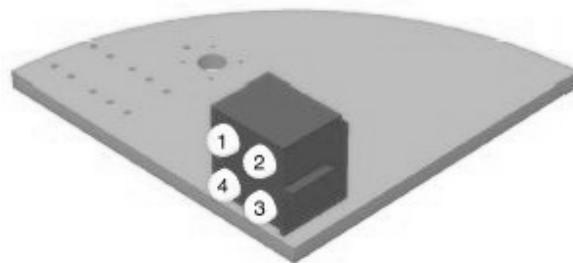
The above diagram shows the location of the main parts of the DeviceNet Fieldbus module.

The DeviceNet connector is on the front left of the picture and conforms to the standard connection form.

- |                     |                           |
|---------------------|---------------------------|
| Terminal 1 = V-     | (Negative supply voltage) |
| Terminal 2 = CAN_L  | (CAN L bus line)          |
| Terminal 3 = SHIELD | (Cable shield)            |
| Terminal 4 = CAN_H  | (CAN H bus line)          |
| Terminal 5 = V+     | (Positive supply voltage) |

The switch's can be clearly seen in the front middle of the picture and a status LED block is located at the front right of the picture.

The statuses LED's are grouped in a single block of four and indicate the following status.



Led 1 Status

Not used in this version of the Fieldbus module.

### Led 2 Network Status

<i>State</i>	<i>Description</i>
Off	Not powered / Not On line
Green Steady	Link OK, On Line, Connected
Green Flashing	On Line but not connected
Red Steady	Critical Link Failure
Red Flashing	Connection Timeout

### Led 3 Module Status

<i>State</i>	<i>Description</i>
Off	Not powered
Green Steady	Module initialized and operational
Green Flashing	Data size is bigger than configured
Red Steady	Unrecoverable Fault
Red Flashing	Minor Fault

### Led 4 Status

Not used in this version of the Fieldbus module.

The DeviceNet module is equipped with a 512 byte data memory. This data memory is used to hold the sensor values for the T500 unit connected to the F500. The actual number of sensors that can be read is entirely dependent upon the DeviceNet scanner module used (see appendix 'B'). The data for the sensors is stored in the following manner.

Data Byte	Contents
0	Always 0
1	Activity counter
2	Sensor 1 value
3	Sensor 2 value
4	Sensor 3 value
5	Sensor 4 value
6	Node 1 Ambient temperature
7	Sensor 5 value
8	Sensor 6 value
9	Sensor 7 value
10	Sensor 8 value
11	Node 2 Ambient temperature
.....	.....
317	Sensor 253 value
318	Sensor 254 value
319	Sensor 255 value
320	Sensor 256 value
321	Node 64 Ambient temperature

The data is arranged in a logical order to match the sensors connected to the T500. The first location is always 0 and the second is the Activity Counter. Because the T500 cycle time is dependant upon the number of sensors being monitored, it is important to know when the data has been refreshed. The activity counter provides this information. Providing the T500 is updating the data to the F500 this counter will increment by 1 every time new data is received by the F500. The counter will increment between 0 and 255 and it will then return back to 0 on a continuous basis. Each T500 can be assigned a unit number 0 or 1. Assigning a 0 unit number means that the T500 will not respond to the F500 pole requests. If the number 1 is selected then the T500 will provide data in a manner described above.

The sensor data is presented as Hexadecimal (\$) in single bytes representing sensor values or ambient temperatures. Each value represents the most recent update for that sensor or node. The DeviceNet scanner should be configured to read data in a byte format and should be set to operate on a byte boundary.

#### NTC Temperature sensors

Positive temperatures values are between \$0°C and \$6E°C. Negative temperature values are represented by numbers between \$7F and \$96. To calculate negative temperatures subtract \$7F from the value and the result is a negative temperature between -\$0°C and -\$1F°C (e.g. \$8A – \$7F = -\$0B°C). If the value is \$EE then this represents an open circuit sensor. If the Value is \$FE this represents a sensor which is above the calibrated range and if the value is \$FF then this represents a short circuit sensor.

#### PTC Temperature sensors

As the PTC sensor types can only be represented as NORMAL or HOT, there is only need to provide two values to indicate the state of the sensor. If the value is \$F0 then the sensor is NORMAL and if the value is \$F1, then the sensor is HOT.

#### CNT (Contact) Sensors

As the CNT sensor types can only be represented as OPEN or CLOSED, there is only need to provide two values to indicate the state of the sensor. If the value is \$FA then the contact is OPEN and if the value is \$FB, then the contact is CLOSED.

#### Ambient Temperatures

See the details for the NTC Temperature Sensor above.

The ambient temperatures are taken from a sensor located on each TN4 sensor node.

#### Communications Errors

If the T500 fails to communicate correctly with the TN4 node then it will report a communications error and the F500 will mirror this error by sending the code \$EF.

#### Sensor not configured.

If a sensor returns the value \$FD, this indicates that the T500 hasn't been programmed to scan this sensor.

Below is a table showing a complete list of the data represented in the F500

Decimal	Hex	Description
0 – 110	\$00– \$6E	NTC Temperature 0°C to 110°C
127 – 158	\$7F– \$9E	NTC Temperature -0°C to -31°C
238	\$EE	NTC open circuit sensor
239	\$EF	Communications error (lost contact with sensor node)
240	\$F0	PTC Sensor in the NORMAL state
241	\$F1	PTC Sensor in the HOT state
250	\$FA	CNT contact in the OPEN (off) state
251	\$FB	CNT contact in the CLOSED (on) state
253	\$FD	This sensor not programmed for scanning.
254	\$FE	NTC Temperature above maximum range
255	\$FF	NTC sensor is short circuit?

As the temperatures are in °C it might be necessary to convert the value to °F  
 Calculate the temperature value complete with sign and call it T°C, therefore  
 $T^{\circ}\text{F} = (T^{\circ}\text{C} * 1.8) + 32$

E.g. If T°C = 20°C then T°F = (20 \* 1.8)+32 = 68°F  
 If T°C = -20°C then T°F = (-20 \* 1.8) + 32 = -4°F

#### Electronic Data Sheet (EDS)

An electronics data sheet is supplied with each unit to simplify the configuration of the F500 interface when connected to DeviceNet. Importing and then downloading this EDS to the scanner module or other similar device will allow the module to be accessed by either of the following methods

- † Explicit Messaging
- † Polled I/O
- † Bit-strobed I/O
- † Change of state / Cyclic I/O

A number of explicit messaging options are available but the most widely used one is as follows.

I/O data Input Mapping Object: Class A0h, Instance 1h, Attribute 1h

This will result in 512 bytes of data being returned in the format described on page 6 of this manual. For further information relating to explicit messaging contact your DeviceNet supplier.

F500 software version 2.0.2 is shipped with the DeviceNet interface preconfigured to suit your installation. You must configure your scanner module to the same number of data bytes in order to used polled I/O, Bit strobe I/O and Change of State I/O. Refer to Appendix 'B' for further detail.

**CHECK LIST**  
**For problems after initial start-up**

1. Is there excessive interference on the electrical power supply? Power conditioners and surge (spike) suppressor may have to be fitted.
2. Has the wiring for the F500 and Fieldbus been routed away from power cables?
3. Is the F500 Elite circuit properly grounded?
4. Is the Micro-processor control unit overheating, if so mount the unit in a temperature-controlled environment of maximum temperature 113°F (45°C).
5. Check that high powered 'Walkie Talkie' radios are not operated immediately near the control unit or F500 as this will affect the performance.
6. Check that the communications/power cable is connected correctly and in accordance with DRG A,B,C and D.
7. Check the led status indication as described on page 5 and 6
8. If the T500 unit does not respond or is intermittent, check that the termination resistors are correctly fitted.
9. If your scanner module shows E#77 (error 77) for the F500 node number, then you have incorrectly set the data size in the scan list for the F500. Please refer to Appendix 'B'

**CONTACT INFORMATION**

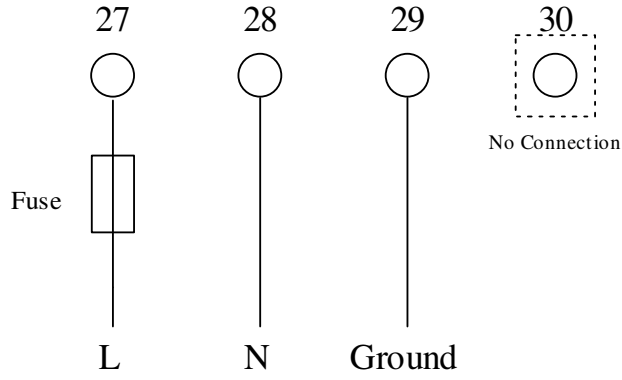
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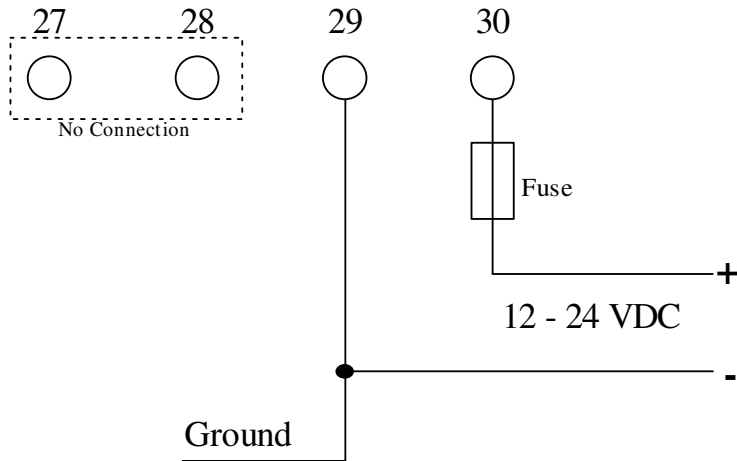
### Drawing 'A'



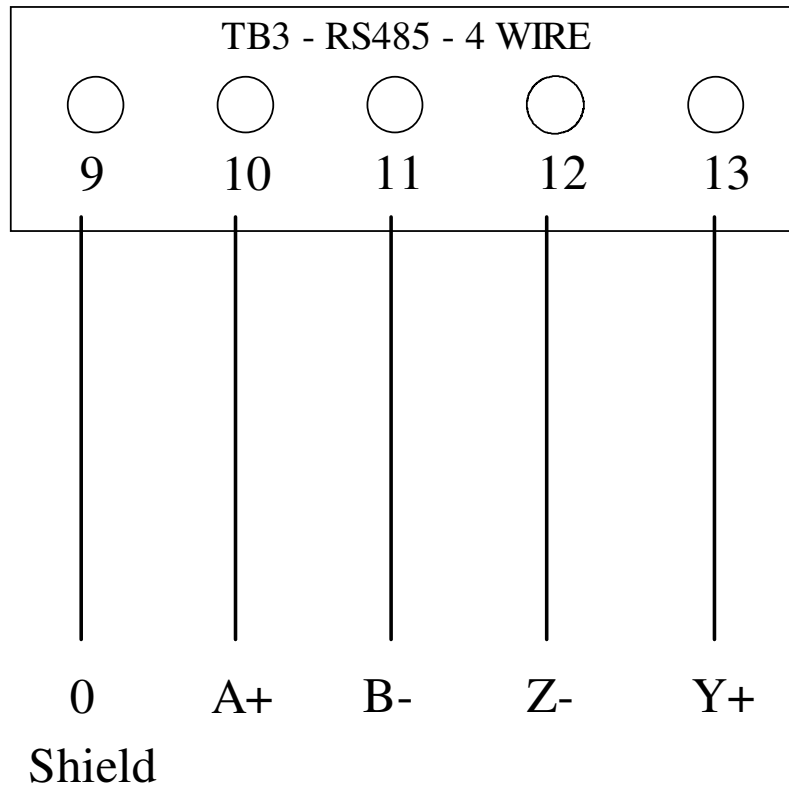
115 - 240 VAC 50/60 Hz

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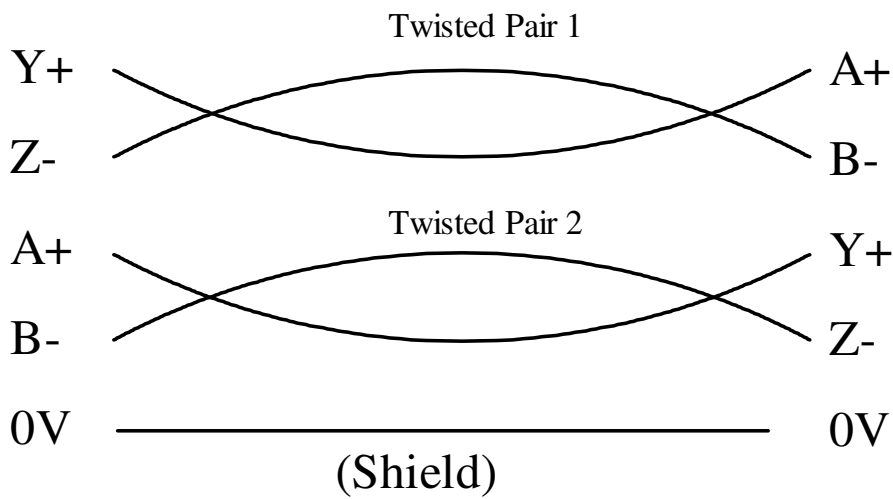
### Drawing 'B'



## T500 Elite to F500 Elite Connection Diagram

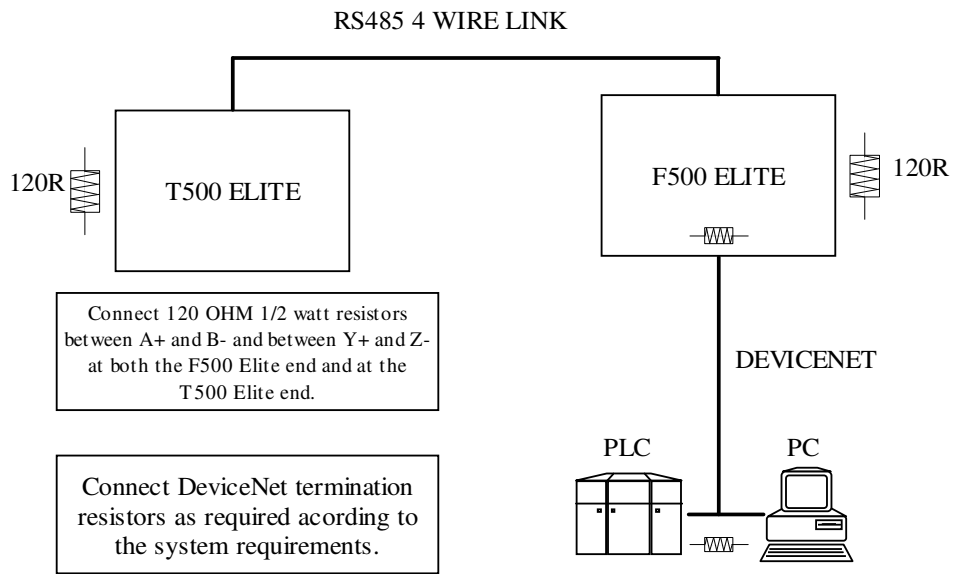


T500 Elite RS485 Connection



F500 Elite RS485 Connection

Drawing 'C'



Drawing 'D' General Connection Detail.

## Appendix ‘A’

The table below represents the settings for the modules MAC address switch as described on page 5. The F500 is supplied with a default MAC address of 1. The switches are numbered 1 to 8 left to right but the address only uses switch 3 to 8, switch 8 represents the lowest binary number. In the table below a ‘0’ represents the switch in the OFF or UP position and a ‘1’ represents the switch in the DOWN or ON position.

MAC ID: SW345678

01	000001	17	010001	33	100001	49	110001
02	000010	18	010010	34	100010	50	110010
03	000011	19	010011	35	100011	51	110011
04	000100	20	010100	36	100100	52	110100
05	000101	21	010101	37	100101	53	110101
06	000110	22	010110	38	100110	54	110110
07	000111	23	010111	39	100111	55	110111
08	001000	24	011000	40	101000	56	111000
09	001001	25	011001	41	101001	57	111001
10	001010	26	011010	42	101010	58	111010
11	001011	27	011011	43	101011	59	111011
12	001100	28	011100	44	101100	60	111100
13	001101	29	011101	45	101101	61	111101
14	001110	30	011110	46	101110	62	111110
15	001111	31	011111	47	101111	63	111111
16	010000	32	100000	48	110000	00	000000

The baud rate can be set by switch 1 and 2

00xxxxxx	125 K baud
01xxxxxx	250 K baud
10xxxxxx	500 K baud
11xxxxxx	Reserved, don't use

## Appendix 'B'

### Software version 2.0.2.162

DeviceNet and its implementation are governed by a set of rules determined by the ODVA ([www.odva.org](http://www.odva.org)). The DeviceNet module used in the F500 conforms fully to the device specifications laid down in profile number 12, and acts as a 'Group two only server' on the DeviceNet network. The F500 has been designed with as much flexibility in mind as possible. However, when using the F500 with other DeviceNet systems such as Allen Bradley a number of limitations apply. The F500 is a DeviceNet slave and will not instigate the transmitting of data without the proper instruction from a master unit, which in most cases is a DeviceNet scanner module. An example of this is the Allen Bradley 1756 DNB module. This DeviceNet scanner allows a Control Logix PLC to be connected to a DeviceNet system with multiple slave node units attached of which the F500 is one of them. The 1756 DNB has a limited amount of memory available to it and each slave unit connected will require the use of some of this memory. Currently the 1756 DNB has 490 bytes of data memory of which a maximum of 255 bytes can be allocated to a slave unit. Therefore, the **maximum** amount of data that can be read from an F500 is 255 bytes. Each sensor node connected to the T500 has 4 sensors inputs and an ambient temperature sensor. This means that the data for 5 sensors is available from each node. Therefore, the amount of TN4 nodes that can have their data retrieved by the F500 is determined by the amount of memory available to the scanner module. If a scanner module has 255 bytes free, then  $255 / 5 = 51$ , the maximum amount of memory available is 255 bytes and each nodes presents 5 bytes of data so you can read the data for 51 nodes. There is also a two byte overhead for the activity counter (Byte 0 and Byte 1) which means that a maximum of 50 nodes can be read by a scanner module.

This applies to a scanner dedicated to the F500 but in many cases the scanner is part of a much bigger system where existing DeviceNet nodes are in place and are using some of the scanners memory allocation. This means that the scanner will have to read fewer than the maximum of 50 nodes as calculated above. The **minimum** is 1 node and this requires 5 bytes + 2 bytes so 7 bytes in total.

In order that the F500 and DeviceNet scanner module communicate successfully they must both be configured with the same amount of data bytes. The F500 Version 2.0.2.162 software has been configured specifically to operate with 162 bytes of data. This means that the data for 32 nodes ( $32 \times 5 + 2 = 162$ ) can be read from the F500. You must therefore set the scanner module to allocate 162 bytes to the Any Bus DeviceNet interface (F500); this can be done by selecting the device from the scan list and editing the INPUT bytes to 162. No output bytes need to be allocated so set this to 0. Don't forget to download the changes to the scanner module for them to take effect.

Other combinations of scanner module and PLC system are available and the amount of data varies according to the equipment used. You must check the scanner module data allocation before implementing the F500 DeviceNet interface.

Application notes are available from

[http://www.hms-networks.com/applications/appl\\_notes.shtml](http://www.hms-networks.com/applications/appl_notes.shtml)

Two documents are available in PDF form which will help in the initial setting up of the system,

- Establishing I/O communication between AnyBus-S DeviceNet and ControlLogix5000 using RsNetWorx™
- Reading/writing data from AnyBus-S DeviceNet using ControlLogix5000 MSG instruction

The notes are not extensive but do cover the necessary areas. This information may also be used as a guide to configuring other systems such as Allen Bradley SLC500 series PLC and DeviceNet scanner modules.

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