



# **F500 Elite.**

## **FIELDBUS ADAPTER.**

### **T500 Elite to DeviceNet communications. (Software Version 2.2.x)**

**IMPORTANT NOTE:**

**Please refer to APENDIX 'B' for detail configuration of the DeviceNet Interface.**

**Please refer to page 8 and APENDIX 'C' of this manual when converting temperatures from the stored value into actual units.**

Dear 4B Customer:

Congratulations on your purchase. 4B appreciates your business and is pleased you have chosen our products to meet your needs.

Please read in its entirety and understand the literature accompanying the product before you place the product into service. Please read the safety precautions carefully before operating the product. With each product you purchase from 4B, there are some basic but important safety considerations you must follow to be sure your purchase is permitted to perform its design function and operate properly and safely, giving you many years of reliable service. Please read and understand the Customer Safety Responsibilities listed below. Failure to follow this safety directive and the Operation Manuals and other material furnished or referenced, may result in serious injury or death.

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- D. Please see the last page of this manual for all warranty information regarding this product.

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may perform work on your operation that you select a qualified and competent electrical installer to undertake the installation. The product must be installed properly to perform its designed functions. The installer should be qualified, trained, and competent to perform the installation in accordance with Local and National Electrical Codes, all relevant OSHA Regulations, as well as any of your own standards and preventive maintenance requirements, and other product installation information supplied with the product. You should be prepared to provide the installer with all necessary installation information to assist in the installation.

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As all operations are different, please understand that your specific operation may require additional adjustments in the maintenance and inspection process essential to permit the monitoring device to perform its intended function. Retain the Operation Manual and other important maintenance and service documents provided by 4B and have them readily available for people servicing your 4B equipment. Should you have any questions, please call the 4B location who supplied the product or the 24-hour hotline number in the USA -309-698-5611.

#### **6. SERVICE REQUEST AND ONLINE PRODUCT REGISTRATION**

If you have questions or comments about the operation of your unit or require the unit to be serviced please contact the 4B location who supplied the product or send your request via fax (309-698-5615), email (4b-usa@go4b.com), or call us via our 24-hour hotline number in the USA - 309-698-5611. Please have available product part numbers, serial numbers, and approximate date of installation. In order to assist you, after the product has been placed into service, complete the Online Product Registration section which is accessed via our website [www.go4b.com](http://www.go4b.com)

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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 100v 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	-	100 to 230VAC +/- 10% 50/60Hz
	-	24VDC +/- 10%
Power Consumption	-	12 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

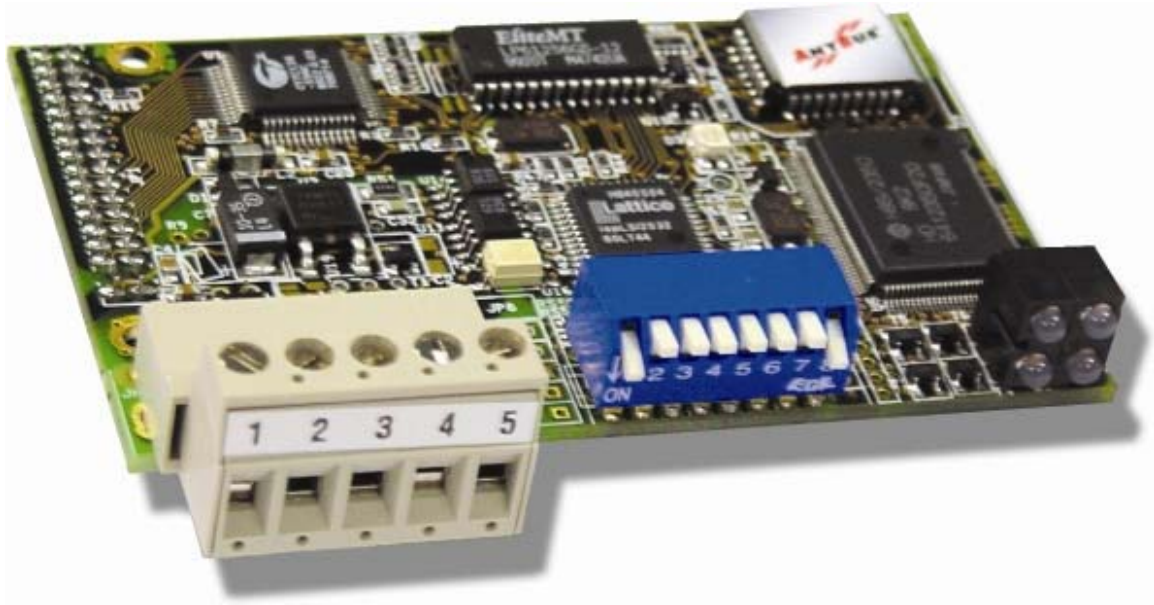
The configuration switch shown in the picture on page 5 and allows selection of the baud rate and the units MAC address. The switches are numbered left to right 1 to 8. The switch is OFF when in the UP position and ON when in the DOWN position.

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.



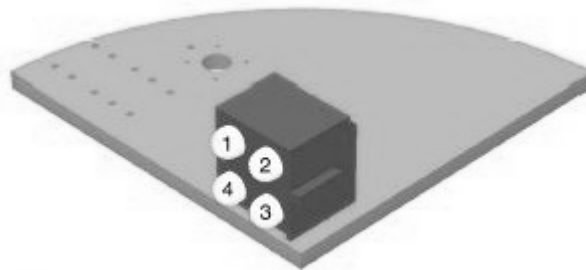
The above diagram shows the location of the main parts of the DeviceNet Fieldbus module.

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.

**The F500 software version 2.2.x must be configured to suit your installation. You must configure your scanner module to the same number of data bytes as the T500 in order to use 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**

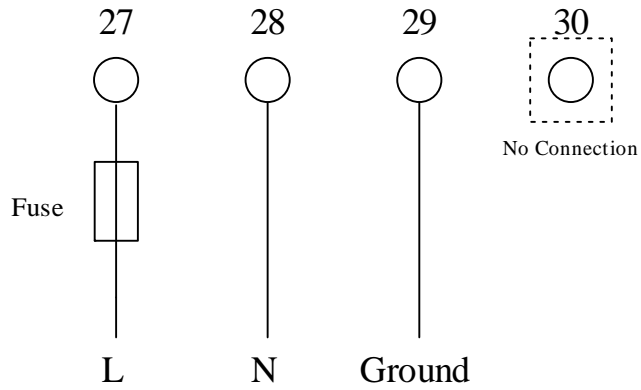
1. Is there excessive interference on the electrical power supply? Power conditioners and surge (spike) suppressor may have to be fitted.
2. Has the wiring for the F500 and Fieldbus been routed away from power cables?
3. Is the F500 Elite circuit properly grounded?
4. Is the Micro-processor control unit 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**



[www.go4b.com](http://www.go4b.com)

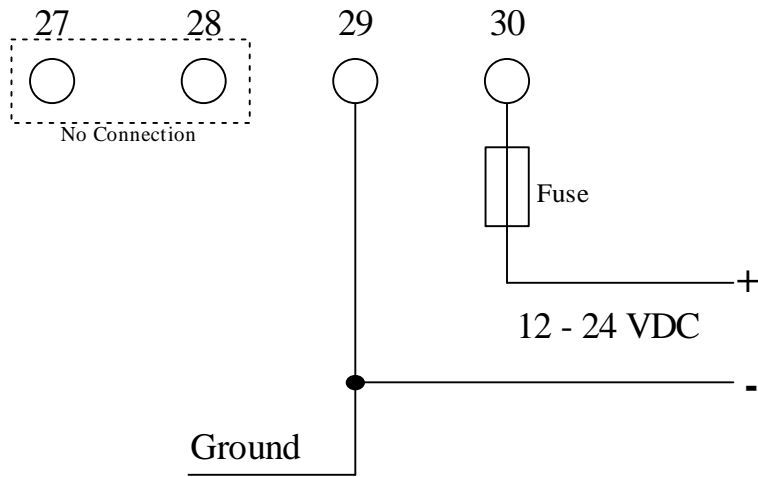
### Drawing 'A'



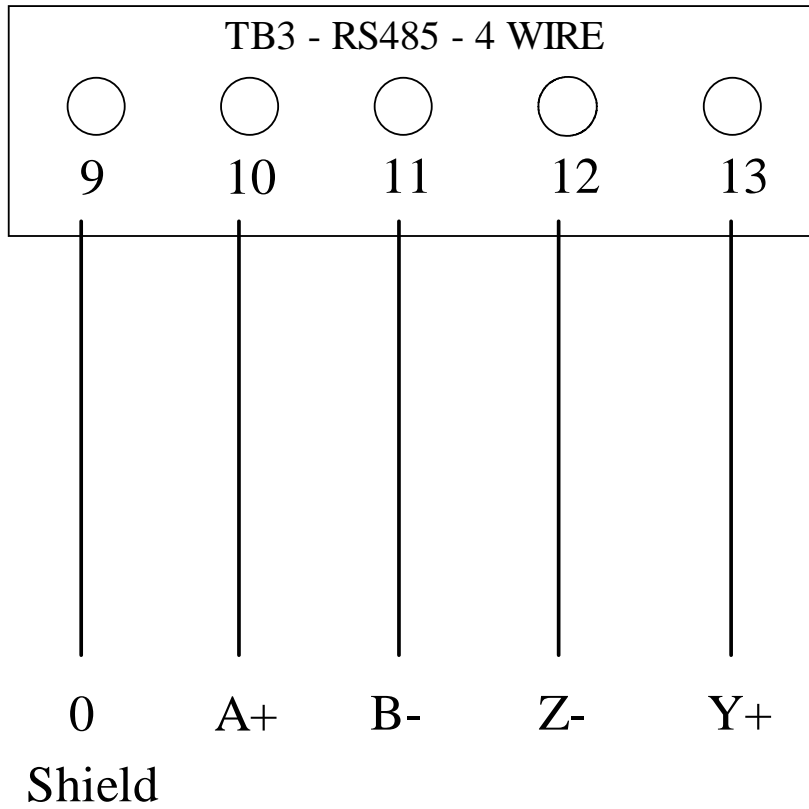
115 - 240 VAC 50/60 Hz

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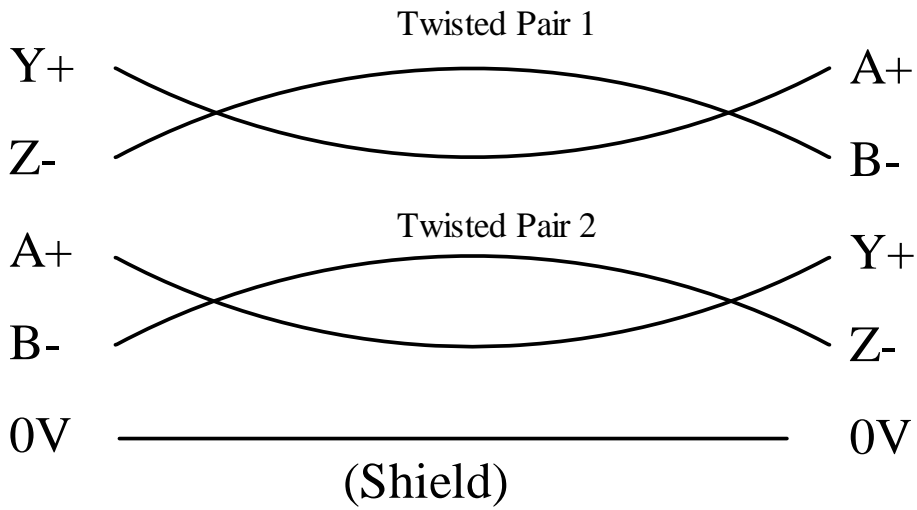
### Drawing 'B'



# T500 Elite to F500 Elite Connection Diagram

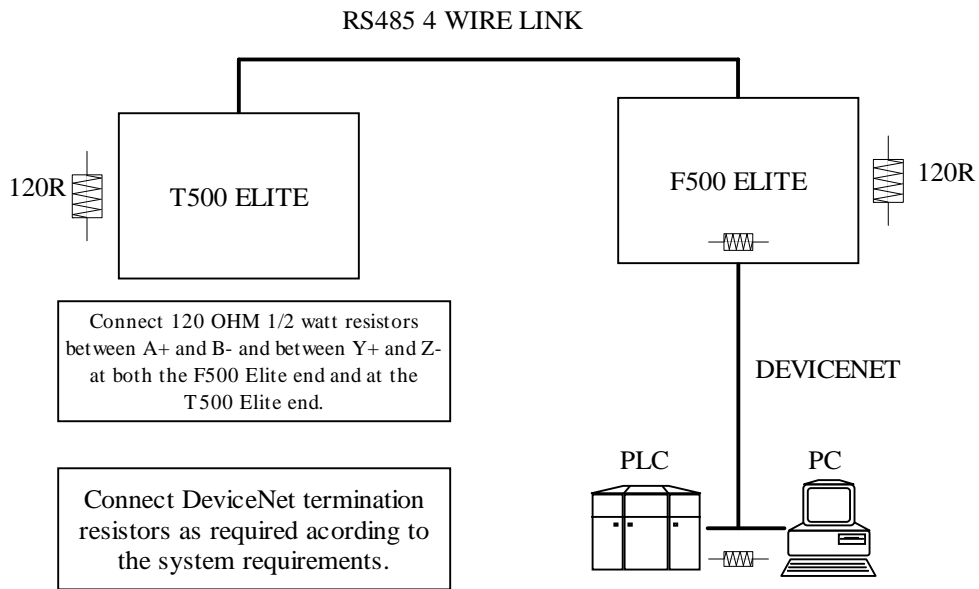


T500 Elite RS485 Connection



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 2.2.x

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 2.2.x software has been designed to read the number of configured data bytes from the T500 unit. The T500 software must be version 3.0.0 onwards and you should refer to the T500 manual (section **4.8.2**) for a more detail description of setting the free space bytes.

Therefore, if you want to read the data for 32 nodes ( $32 \times 5 + 2 = 162$ ) from the F500 you must first 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. Once that is done you need to change the FREE SPACE BYTES settings in the T500 to 162.

Communications will NOT take place until the two numbers match. If you change the Free Space Bytes in the T500 you **must reboot the F500** in order for it to take effect.

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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## Appendix 'C'

Because of the design limitations the temperatures measured by the T500/F500 system are in a coded hexadecimal format. It is therefore necessary to apply some conversion to the number in order to extract the actual temperature. Once extracted, the temperature is in °C so if you require the temperature to be in °F, further conversion will be required.

The temperature sensors are capable of measuring between -31°C and +110°C (-23°F and +230°F). Because negative numbers cannot be directly represented in the T500/F500 then some form of coding is needed. Therefore the following rules apply.

Convert the number from Hexadecimal to Decimal (see the following pages for help with this).

If the measured temperature is between 0°C and +110°C (all positive numbers) then the value represents the actual temperature. E.g. Decimal 58 means 58°C.

If the measured temperature is between -0°C and -31°C (all negative numbers) then the value read represents the negative temperature +127. Therefore, numbers between 127 and 158 are used to represent -0°C to -31°C. To get the negative number, first convert the hexadecimal number to decimal. Then, if the number is between 127 and 158 simply subtract 127 taking the remainder as a negative value.

E.g.

If the value is 143, then subtract 127 ( $143-127 = 16$ ) leaving a temperature of -16°C

If the value is 127, then subtract 127 ( $127-127 = 0$ ) leaving a temperature of -0°C

If the value is 128, then subtract 127 ( $128-127 = 1$ ) leaving a temperature of -1°C

If the value is 158, then subtract 127 ( $158-127 = 31$ ) leaving a temperature of -31°C

Values between 111 and 126 and above 158 are reserved for representing other conditions (see page 8) and should not be treated as a temperature.

As the temperatures are in °C it may be necessary to convert the value to °F  
Calculate the temperature value complete with sign and call it T°C, therefore  
 $T^{\circ}\text{F} = (T^{\circ}\text{C} * 1.8) + 32$  or  $T^{\circ}\text{F} = (9/5)*T^{\circ}\text{C}+32$

E.g. If T°C = 20°C then T°F =  $(20 * 1.8)+32 = 68^{\circ}\text{F}$

If T°C = -20°C then T°F =  $(-20 * 1.8) + 32 = -4^{\circ}\text{F}$

Further conversions will be necessary to convert to °Kelvin or °Rankine.

## Hexadecimal to Decimal Conversion.

Hexadecimal is base 16.

Base 16 is where the 'numbers' you can use are zero through to the letter F (0123456789ABCDEF). i.e. the decimal value for '1' is represented in hexadecimal as '1' but the hexadecimal value of '15' (decimal) is shown as 'F' (hexadecimal) and the value of '17' (decimal) is '11' in Hexadecimal.

Decimal	Hex	Decimal	Hex	Decimal	Hex
1	1	11	B	30	1E
2	2	12	C	40	28
3	3	13	D	50	32
4	4	14	E	60	3C
5	5	15	F	70	46
6	6	16	10	80	50
7	7	17	11	90	5A
8	8	18	12	100	64
9	9	19	13	500	1F4
10	A	20	14	1000	3E8

$16^3$	$16^2$	$16^1$	$16^0$
4096	256	16	1

Example 1: Hex 3E8

$$0 \quad 3 \quad E \quad 8$$

$$0 + (3*256) + (14*16) + 8 = 1000 \text{ decimal}$$

Example 2: Hex 5A

$$0 \quad 0 \quad 5 \quad A$$

$$0 + 0 + (5*16) + (1*10) = 90 \text{ decimal}$$

## **WARRANTY INFORMATION**

### **1. EXCLUSIVE WRITTEN LIMITED WARRANTY**

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