Introduction

This application note describes how to set up DeviceNet communication between a Danfoss FC 300 frequency converter and 1756-DNB DeviceNet Scanner from Allen Bradley. It is assumed that you have some knowledge of RS Logix, the DeviceNet Scanners and ladder logic.

This note describes:

- FC 300 DeviceNet card
- Configuration of the FC 300 with RS Networx
- ADR - Auto Device Recovery
- I/O communication with RS Logix 5000
- Explicit messages with RS Logix 5000

NOTE!:
The examples do not describe all the functions needed for a real application, for example error handling.

The examples are based upon that a RS Logix5000 project has been created, and the 1756-DNB has been added to the I/O configuration.

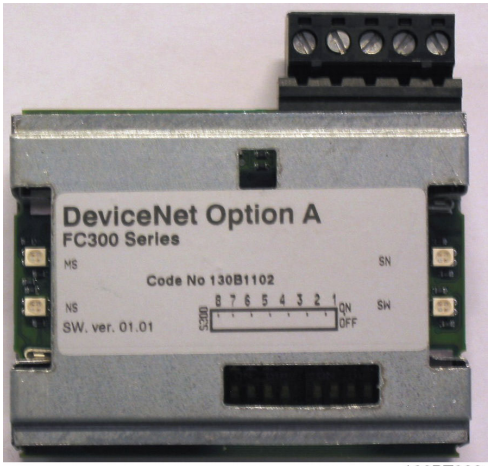
Details of some of the components/ software:
FC 300 with DeviceNet version 2.5.
1756-DNB Series A Firmware Revision 6.002
RS Networx version 5.11.00
RS Logix 5000 version 13.00.00

FC 300 DeviceNet card

The photo shows the DeviceNet card which can be installed in FC 300 Series.

MS Module status LED

NS Network status LED



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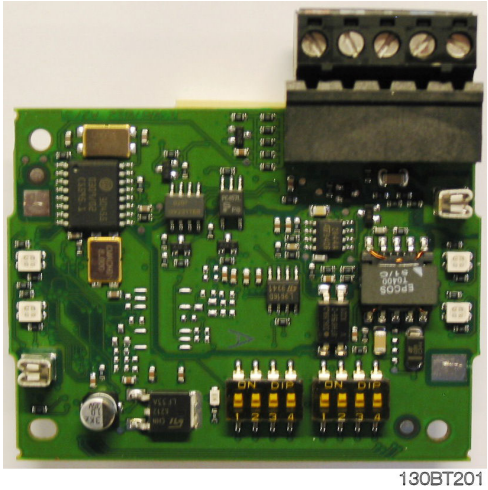
NS Network status LED

MS Module status LED



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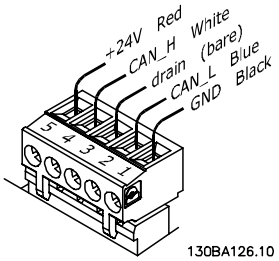
Address switch and baud rate setting

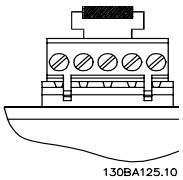
DeviceNet connection



DeviceNet termination

Termination resistors should be installed at each end of the bus line.
The resistors must be mounted between terminal 2 CAN_L and terminal 4 CAN_H and should have the following specification:

121 Ohm, 1 % Metal film and 1/4 Watt



LEDs

For the Module Status LED:

1. When the LED is off, no power is applied to the option.
2. When the LED is green, the device is operational
3. When the LED is flashing green, the device is in standby
4. When the LED is flashing red, the device detects a minor fault
5. When the LED is red, the device detects an unrecoverable fault
6. When the LED is flashing red/green, the device is self testing

For the Network Status LED:

1. When the LED is off, the network is non-powered/not online
2. When the LED is flashing green, the network is online but not connected
3. When the LED is green, the network is online and connected
4. When the LED is flashing red, the network has a connection time-out
5. When the LED is red, the network has a critical link failure.

Cable length

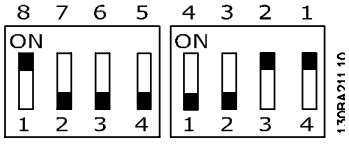
Baud rate	Max. total cable length [m]
125 kBaud	500
250 kBaud	250
500 kBaud	100

Address and baud rate setting

Dip switch 1-6 set the DeviceNet address/ Mac ID and 7-8 the baud rate.
Switch 6 is the Most Significant Bit (MSB) and Switch 1 is the Least Significant Bit (LSB).
When setting the address/Mac ID you must ensure that each device on the network has a unique address. The Baud rate can be read in parameter 10-01 *Baud rate Select* and the address/Mac ID can be read in parameter 10-02 *Mac ID*.

NOTE!:
Switch off the power supply before changing the hardware switches.

If the address is to be set to 3 and the Baud rate to 500 k Baud, the dip switches should be set as follow:



ON = 1
OFF = 0

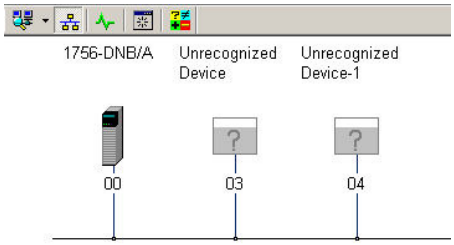
Switch Settings for DeviceNet Module Baud rate:

Baud Rate	Switch Setting 8	Switch Setting 7
125 kBPS	0	0
250 kBPS	0	1
500 kBPS	1	0
125 kBPS	1	1

Creation of an EDS file

In this example the DeviceNet network consists of a FC 301 set up to address 3, a FC 302 set up to address 4 and the Master (1756-DNB) set up to address 0.
Start RS Networx and a new project.

Go online and browse the Network via RS Linx. If RS Networx does not have an EDS (Electronic Data Sheet) installed the Device will be shown as an Unrecognized Device.



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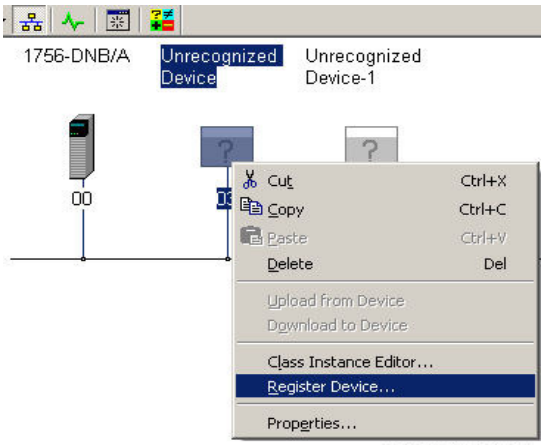
By the FC 300 series the EDS file can be created from the Drive via RS Networx. It is also possible to download the EDS file from http://www.danfoss.com/BusinessAreas/DrivesSolutions

NOTE!:
The EDS file does not contain all parameters but a selected, limited number of parameters. Note that an EDS file needs to be created for both FC 301 and 302.
To create an EDS file right click on the "Unrecognized Device" and choose *Register Device*.



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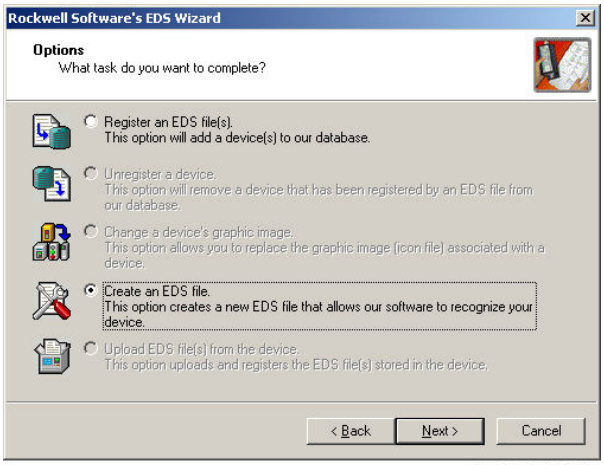
The EDS Wizard is started and click on Next.



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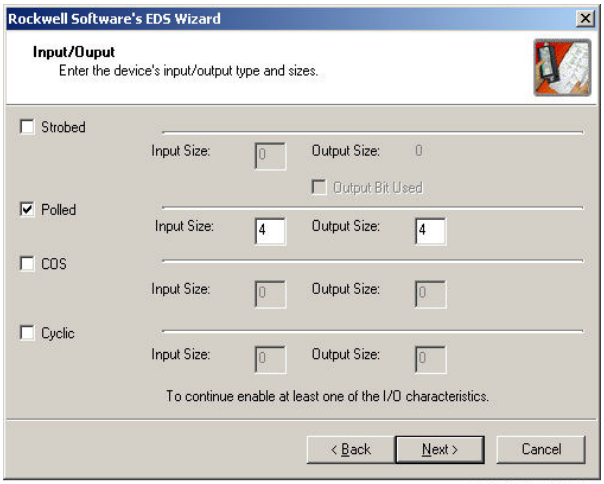
Choose *Create an EDS file* and click on Next.
By Input/Output choose a type and a size. Note that Strobed is not supported FC 301 and 302.

Creation of an EDS file

Click on Next and the EDS file will start to be created from the FC 300 Drive.



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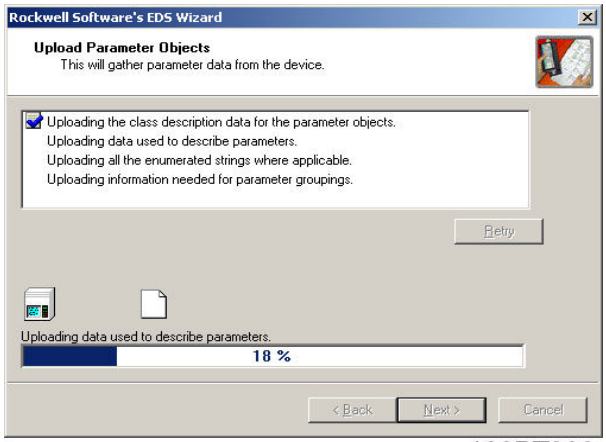
After the Parameter Objects that is used to create the EDS file have been uploaded an Icon can be linked to the FC 300 EDS file.



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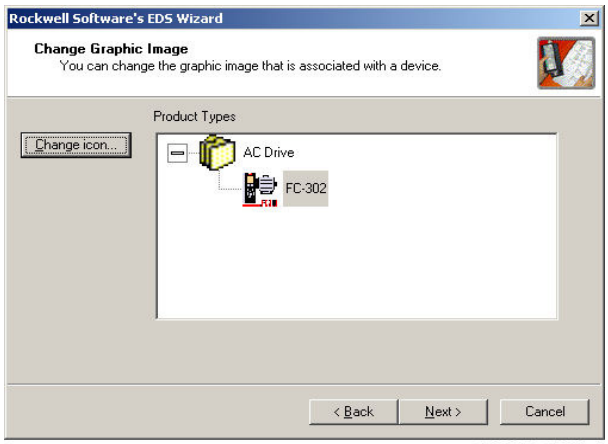
The FC 300 Icon can be downloaded from http://www.danfoss.com/BusinessAreas/DrivesSolutions



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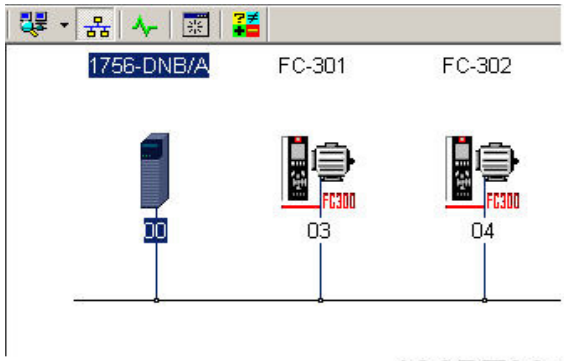
After the EDS files for FC 301 and 302 have been created you can browse the Network again and the Drives will be shown.



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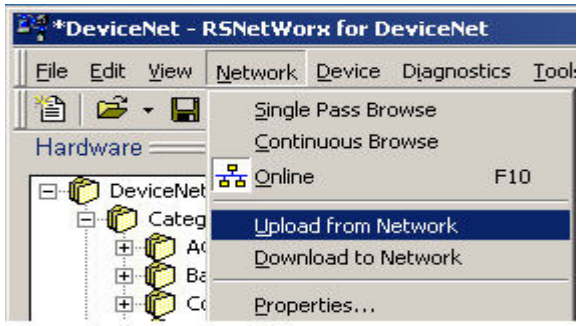
NOTE!:
As the EDS files for FC 301 and 302 will cover all motor and voltage sizes it is necessary to upload the factory setting by the first commissioning. This will secure that the correct motor parameters are used in the EDS file.
Click on *Network* and *Upload from Network*.



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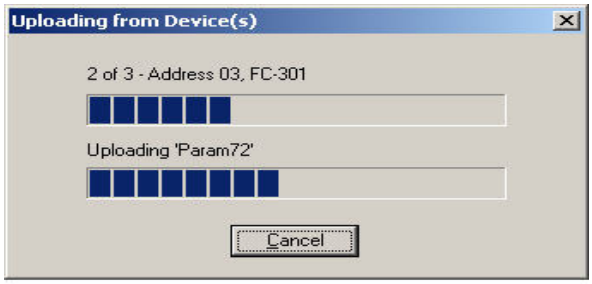
Now all Devices on the DeviceNet will be read.



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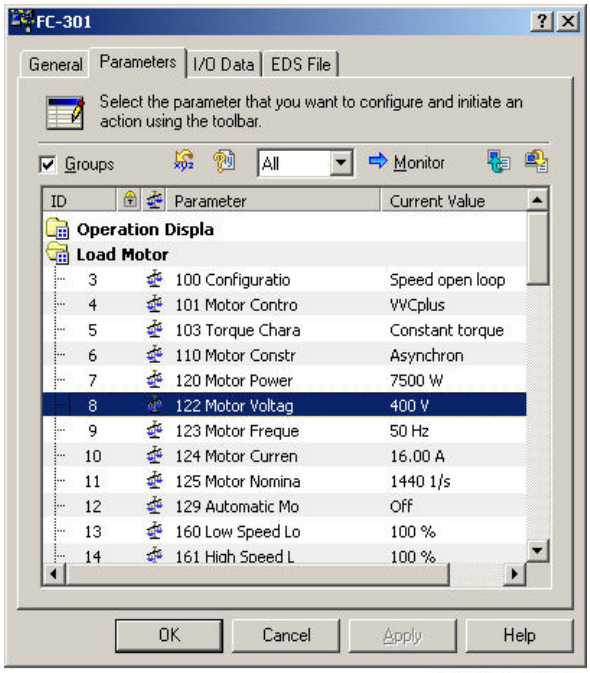
Creation of an EDS file

Double click on one of the FC 300 and the parameters can be changed and downloaded.

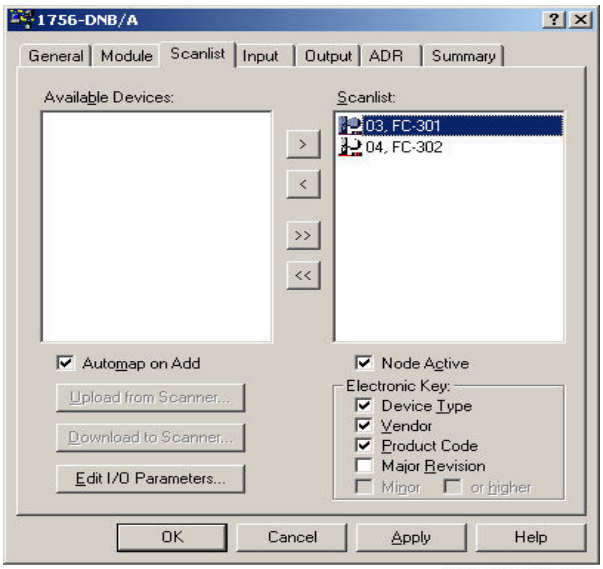


130BT211

Parameter written from RS Networx via the EDS file is from the factory stored in RAM. To store the data in non-volatile memory parameter 10-31 *Store Data Values* or parameter 10-33 *Store Always* can be used.

Configuring the FC 300 with RS Networx

Double click on the 1756-DNB Scanner.
Click on *Scanlist* and add the two Devices from Available Devices to the Scanlist.



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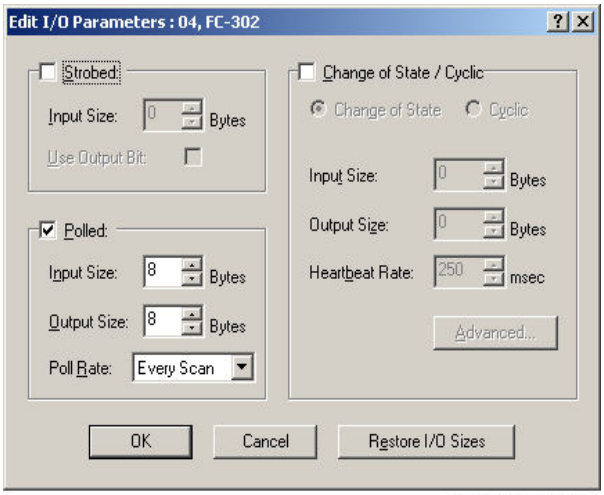
Click on one of the FC 300 and on *Edit I/O Parameters*.

The Polled input/output byte size needs to match the actual instance type in parameter 10-10 *Process Data Type Selection* according to the table below.

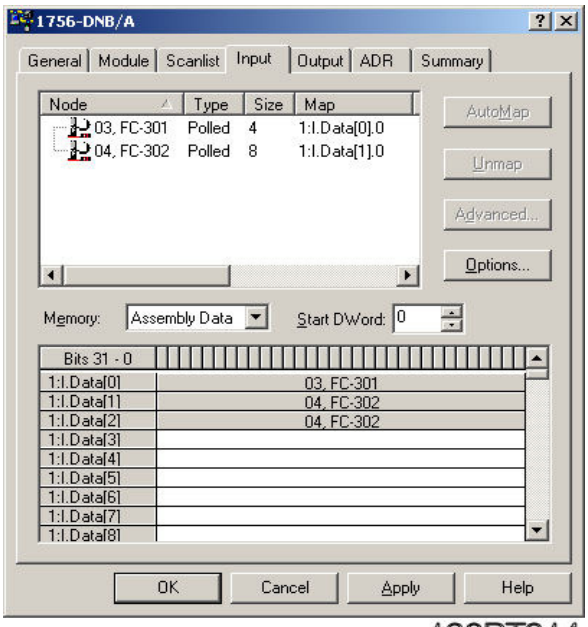
Parameter 10-10	Polled size input	Polled size output
Instance 20/70	4 bytes	4 bytes
Instance 21/71	4 bytes	4 bytes
Instance 100/150	4 bytes	4 bytes
Instance 101/151	8 bytes	8 bytes

In this example FC 301 (address 3) is setup to Polled I/O with 4 bytes using instance 100/150 and FC 302 (address 4) is setup to Polled I/O with 8 bytes using instance 101/151.
The last four bytes of Instance 101/151 can be configured in parameter 10-11 *Process Data Write* and 10-12 *Process Data Read*.



130BT213

Click on Input and if you click on AutoMap the I/O area of the FC 300 Devices will be added to the first free area, here I 0.0.
Note that the I/O area of the Control logix Scanner is organised as 32 bits (double word). This may vary by other Scanner types.
This means that the FC 301 (address 3) Status word will be read from the I/O area I:0.0 to I:0.15 and the Main Actual Value from I:0.16 to I:0.32.



130BT214

Do the same with the Output to map Control word and reference.

Configuring the FC 300 with RS Networx

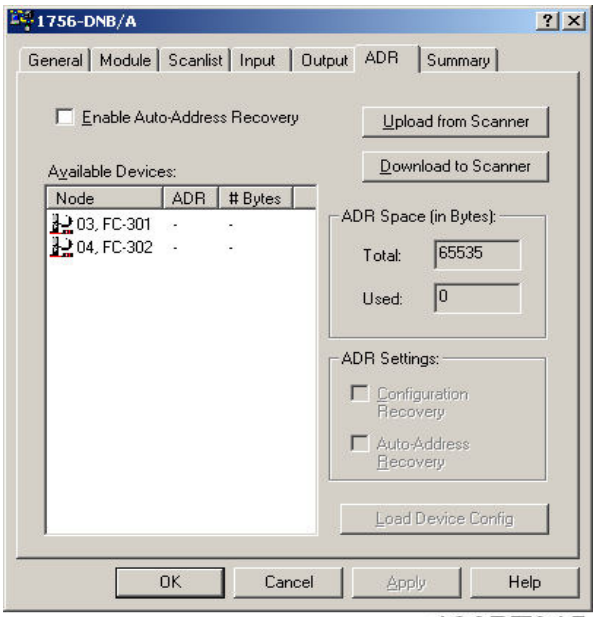
Auto-Device Replacement, or ADR, is a feature that automatic replaces a failed device on a DeviceNet network and returns it to the original setup without having to use a software tool. It consists of two features:

- Configuration Recovery, CR.
  With this feature the Scanner will download the stored configuration (EDS file) to the FC 300 before it begins to exchange I/O data with that device. Notice this will happen by each power up of the Master, so this will expand the power up time.

- Auto Address Recovery, AAR.
  With this feature the scanner (master) will change the device node address from 63 (the default address) to the original address.
  Example: The connection between the Scanner and FC 301 at node address #3 is broken and the FC 301 needs to be replaced. In this situation the Scanner will continually query for a new FC 301 at node address #63. When a new FC 301 is power up with the factory settings and if the Electronic Key of the device that the scanner lost at node address #3 matches, it will change the node address from #63 to #3.
  After Auto Address Recovery the EDS file will be downloaded the node address #3.

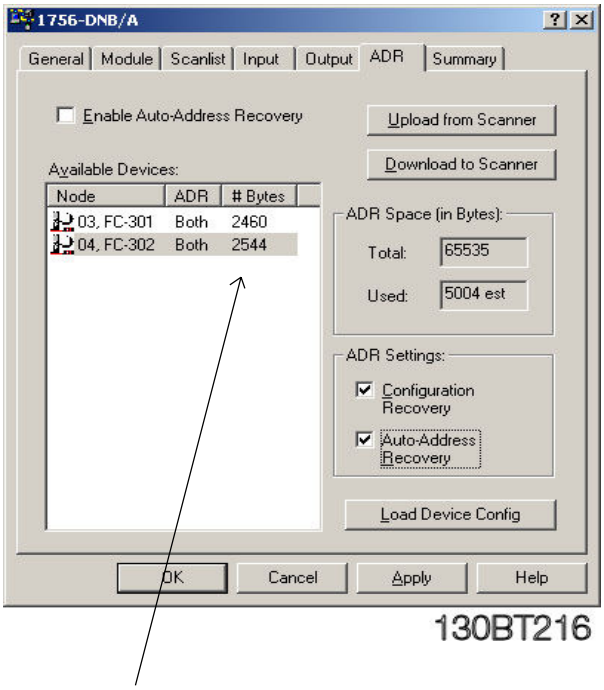
Click on ADR to set up the ADR menu.

The FC 300 can now be seen as an available device for ADR.



130BT215

Click on each node and click on „Load Device Config“. Click also on *Configuration Recovery* and *Auto-Address Recovery* by *ADR Settings* if these functions are require.

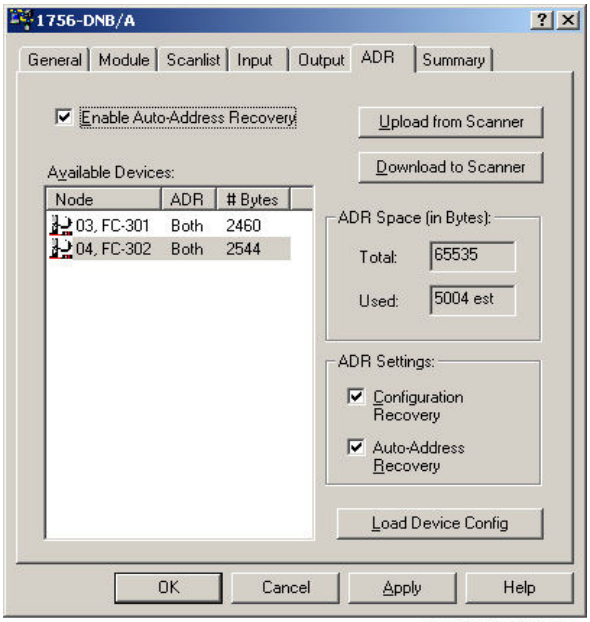


130BT216

This indicates the size of the Device configuration (EDS file).

Configuring the FC 300 with RS Networx

Click on *Enable Auto-Address Recovery* and a Warning will appear. Click Yes to this Warning and set the PLC in Stop (Program).



130BT217

Download the configuration to the Scanner and turn the key on the Scanner to Run to start to communicate with the slaves.

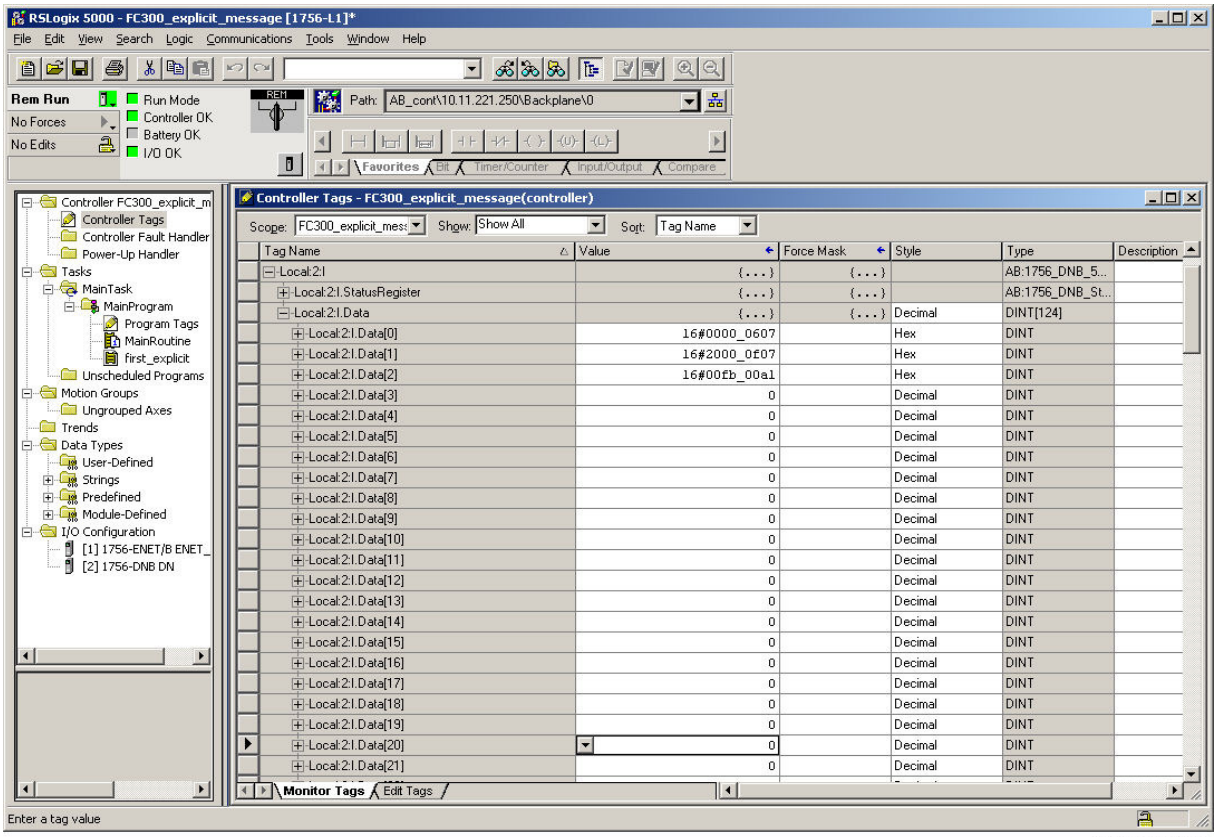
■ I/O communication with RS Logix 5000

Start RS Logix 5000 and a new project.
Make the I/O configuration and click on *Controller tags.*
Click on Local data for the DeviceNet module. Now you can see the full input area of the DeviceNet system.

Choose to see the format in Hex.
See a detailed description of the status word in the FC 300 DeviceNet Operating Instructions (MG33DXYY).

In this example Local:2:I.Data indicates the following:

Device	Address	Input	PCD 1 Status Word	PCD 2 Main Actual Value	PCD 3 Motor current	PCD 4 Motor frequency
FC 301	3	Local:2:I.Data[0]	0607 Hex	0000 Hex	-	-
FC 302	4	Local:2:I.Data[1]	0F07 Hex	2000 Hex	-	-
FC 302	4	Local:2:I.Data[2]	-	-	A1 Hex= 1.61 A	FB Hex= 25.1 Hz



130BT218

Example on status words from FC 301/302 (par. 1010 *Process Data Type Selection = Instance 100/150* or *101/151*):

0607 Hex:	Stand by
0F07 Hex:	Speed = ref. VLT running
0E07 Hex:	Speed ≠ ref. i.e. ramping. VLT running
0F87 Hex:	Warning

■ I/O communication with RS Logix 5000

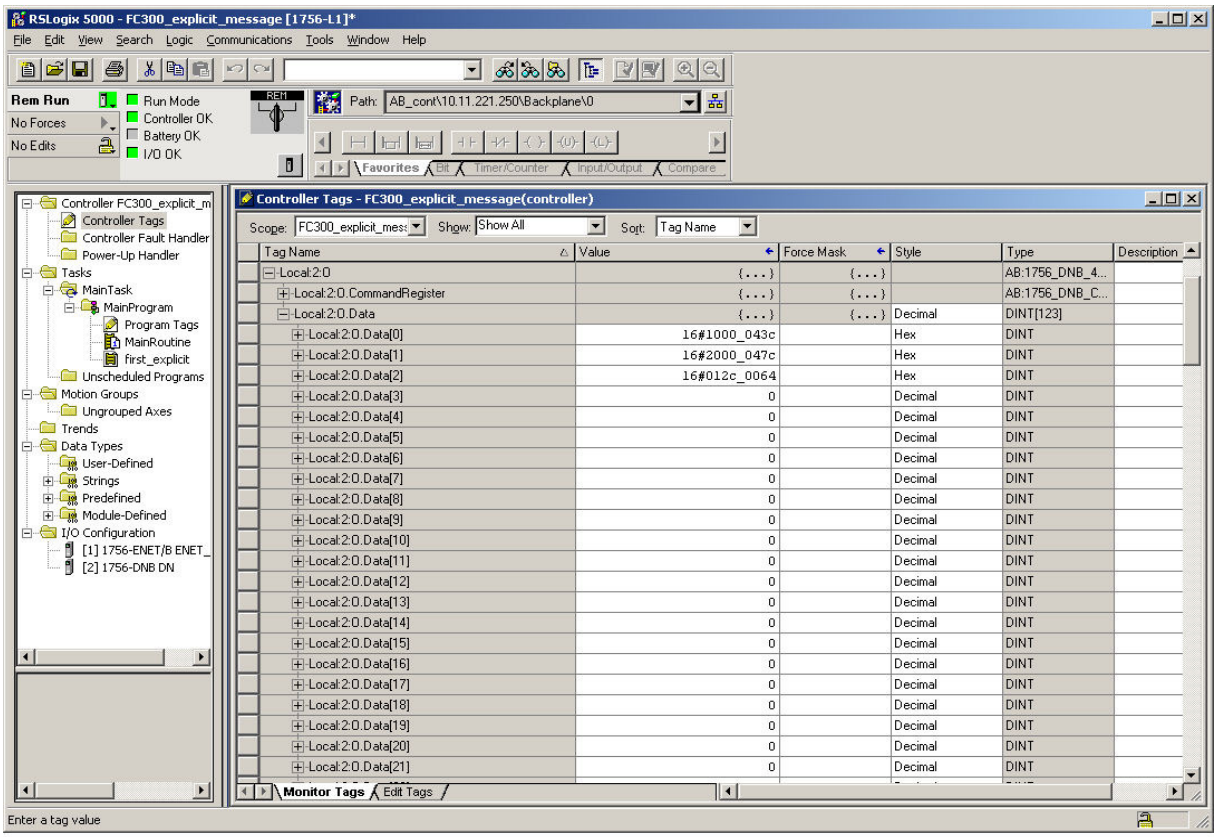
Click on the Local output data. Now you can see the full Output area of the DeviceNet system.

To start the FC 300 when using Instance 100/150 or 101/151 the start command should be 047C Hex. The Reference goes from 0 – 4000 Hex, corresponding to 0 –100 %.

Choose to see the format in Hex.
See a detailed description of the control word in the FC 300 DeviceNet Operating Instructions (MG33AXYY).

In this example Local:2:O.Data[0] indicates the following:

Device	Address	Output	PCD 1 Control Word	PCD 2 Reference 0-4000 hex	PCD 3 Ramp 1 up P.341	PCD 4 Ramp 1 down P.342
FC 301	3	Local:2:O.Data[0]	043C Hex	1000 Hex	-	-
FC 302	4	Local:2:O.Data[1]	047C Hex	2000 Hex	-	-
FC 302	4	Local:2:O.Data[2]	-	-	64 Hex= 1.00 sec	12C Hex= 3.00 sec



130BT219

Example on Control words to the FC 300 (par. 512 *Telegram profile* = *FC Drive* [1]):

047C Hex: Start via ramp time 1
043C Hex: Stop via ramp time 1
0474 Hex: Coast
046C Hex: Quick Stop via Ouick Stop ramp time
847C Hex: Reversing and start

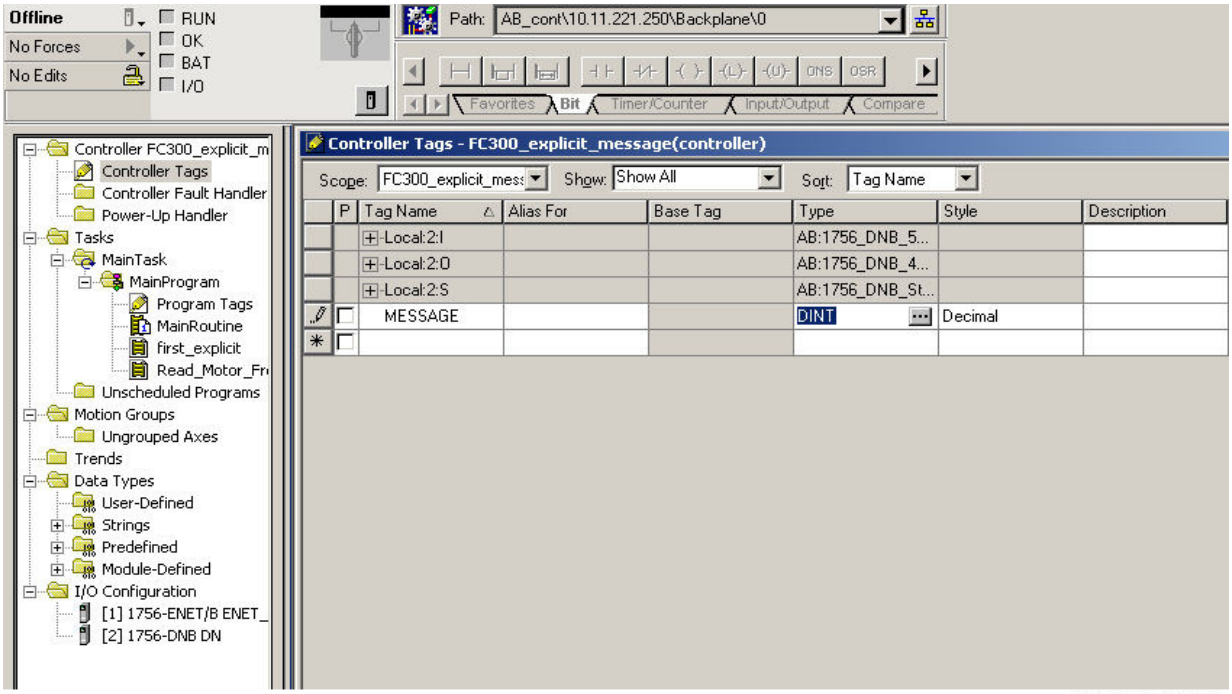
Example on reference to the FC 300 (par. 303 *Max. reference* = 1500 rpm):

1000 Hex ~ 25 % reference = 12.5 Hz
2000 Hex ~ 50 % reference = 25.0 Hz
4000 Hex ~ 100 % reference = 50.0 Hz

Explicit messages with RS Logix 5000

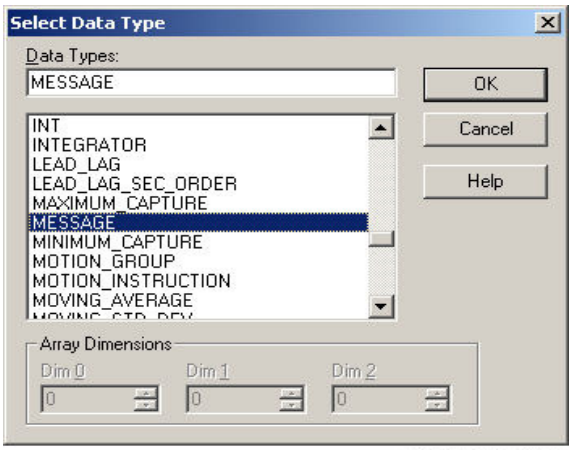
Explicit messages is used to read or write from the PLC to FC 300 parameters.
In this example an explicit message will be set up to read parameter 16-13 *Frequency* and an explicit message to write to parameter 341 *Ramp up time 1*.

Click on *Controller Tags* and add a new tag called MESSAGE.



130BT220

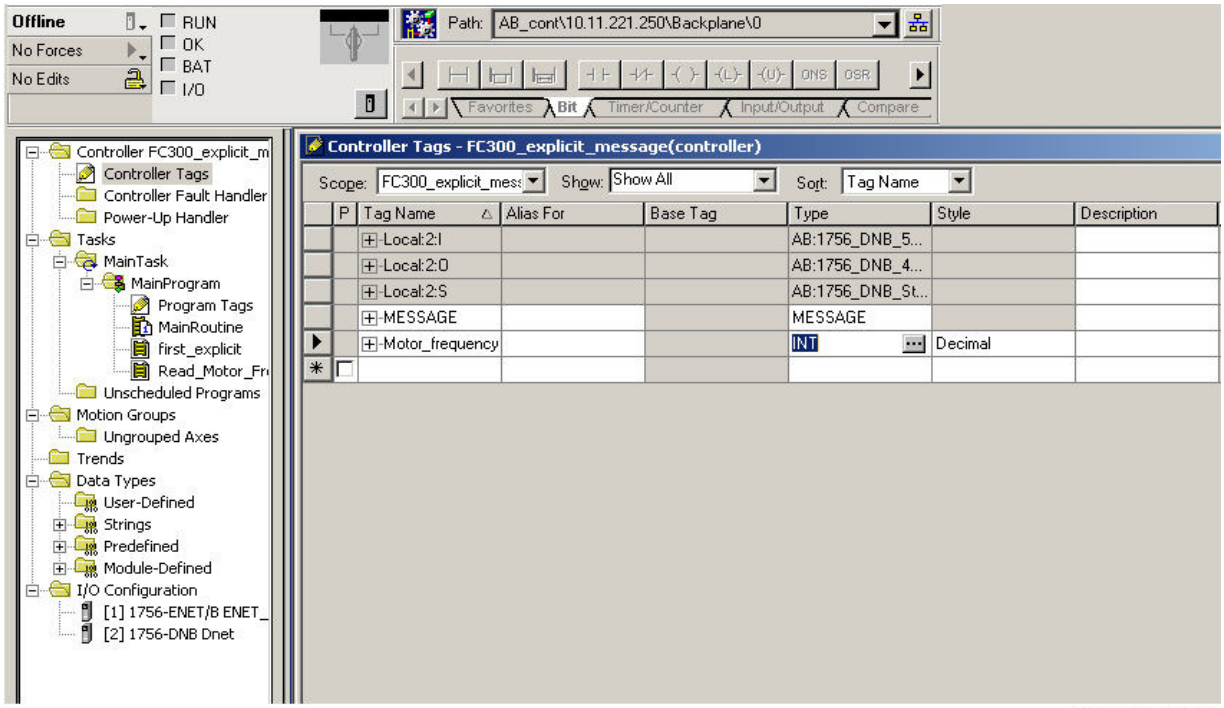
Click on box next to DINT and in *Select Data type* choose MESSAGE.



130BT221

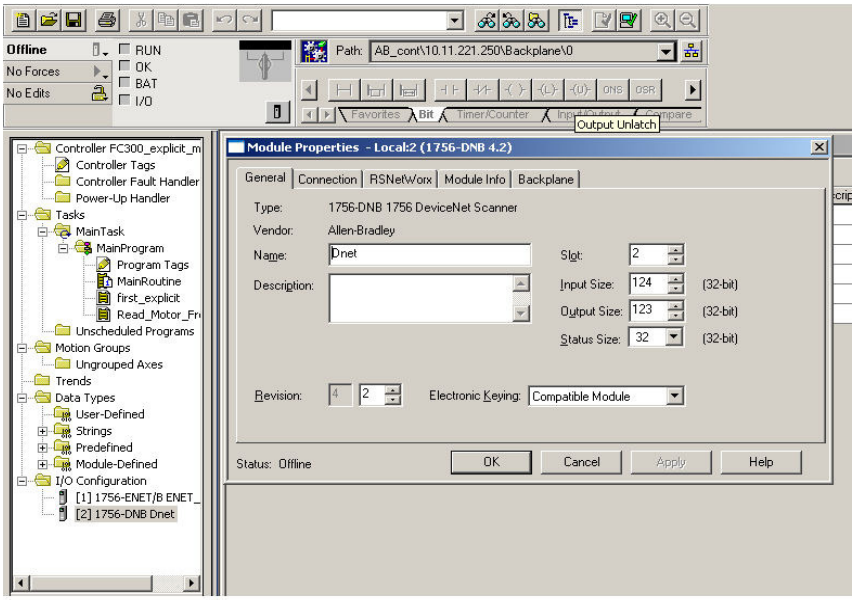
■ Explicit messages with RS Logix 5000

Add a new tag called Motor_frequency.
Click on box next to INT and in *Select Data type* choose INT with an Array of 0.
Now all the Tags are created to read the Motor frequency parameter 16-13 on address number 3.



130BT222

By I/O configuration double click on 1756-DNB Scanner.
Give the Scanner a name, for example *Dnet* and click on OK.

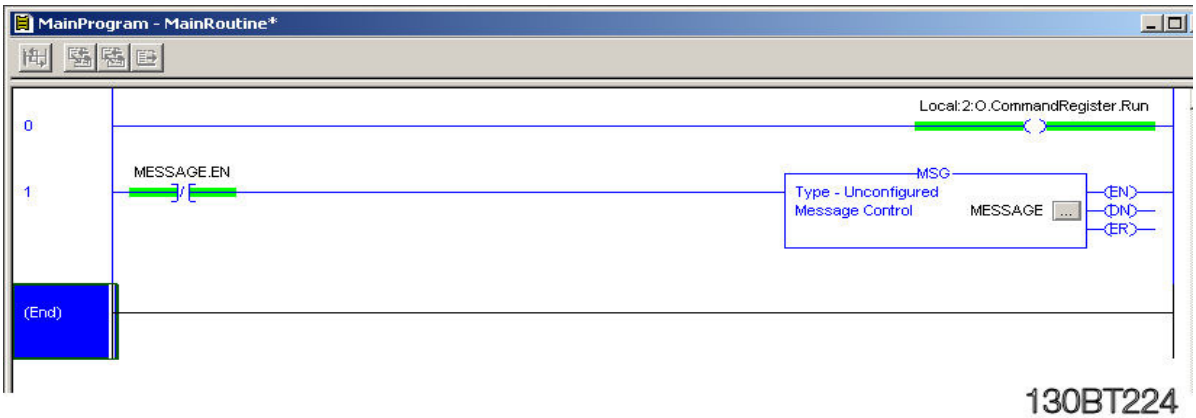


130BT223

Explicit messages with RS Logix 5000

Click on Main routine and add a new rung. Click on the Input/Output tag and drag and drop a MSG block to the rung.
Click on blue ? and choose the MESSAGE tag from the list.

Add an input (Examine Off) to the Message block and set it to MESSAGE.EN.
In this example the Scanner always reads the Motor frequency.

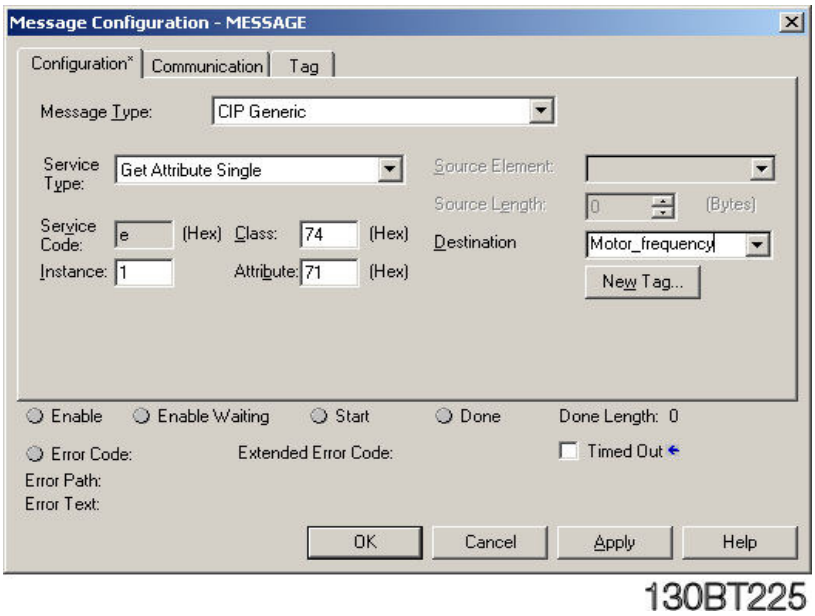


Click on box next to MESSAGE to configure the read command of parameter 16-13 *Motor frequency*.

Set the Message Configuration to the following:

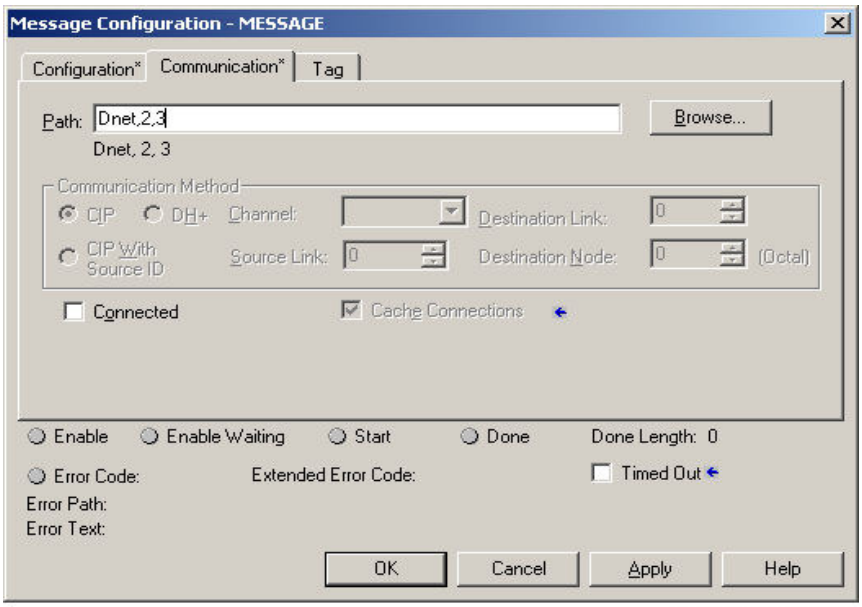
Message Type:	CIP Generic
Service Type:	Get Attribute Single (Read command)
Class:	74 Hex (116 dec). This is the Class ID for Group 1600. See page 17.
Instance:	1 Hex. Set always this to 1.
Attribute:	71 Hex (113 dec). The attribute is the last two digits of the parameternumber + 100.

Set the Destination to the Motor_frequency tag and the message is now set up to read par. 16-13 *Motor frequency.*



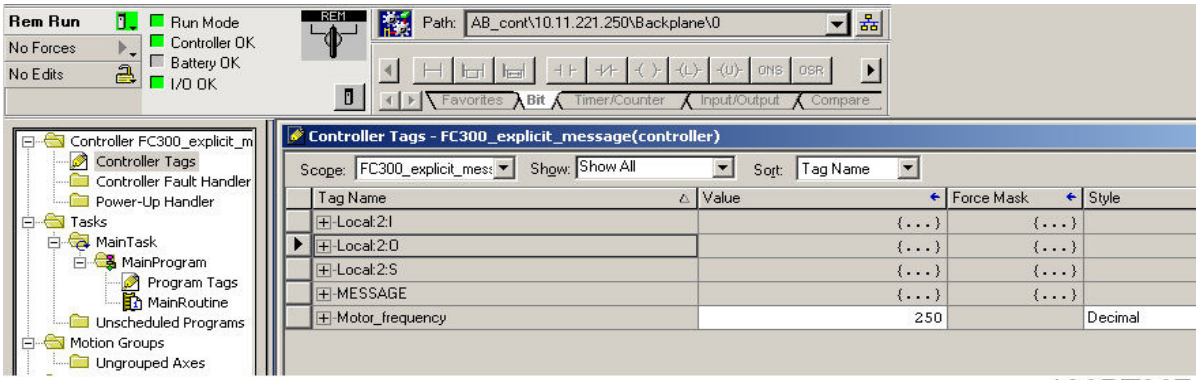
Explicit messages with RS Logix 5000

Click on Communication and create a path to the FC 301 at address 3.
Dnet is the name of 1756-DNB Scanner and 2 is a fixed number and 3 is the address of FC 301. Click Apply and OK.



130BT226

Save the program and download it to the scanner.
Click on controller tags and give the FC 301 a start signal.
By Motor_frequency the actual frequency is shown. 250 means that the actual frequency is 25.0 Hz due to the conversion index of -1.



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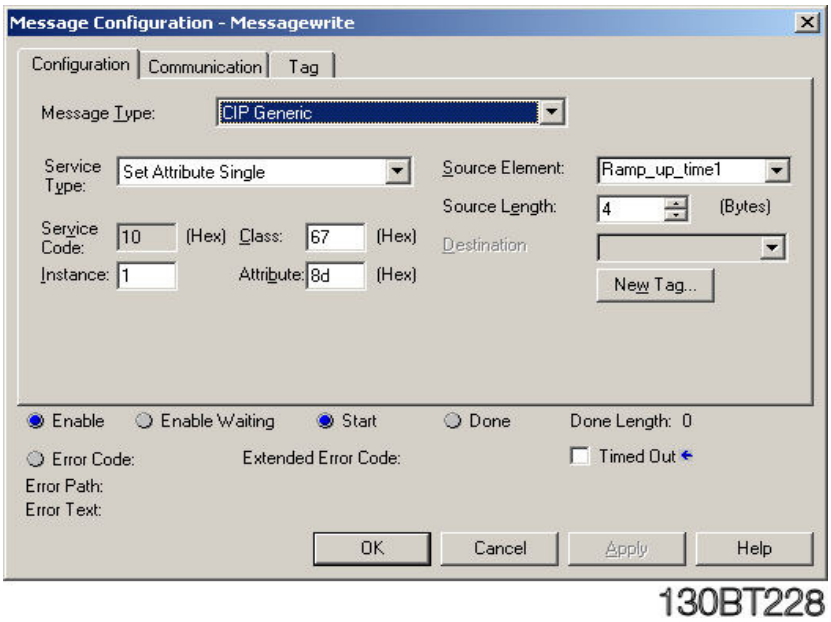
Explicit messages with RS Logix 5000

If you want to write to a parameter you must use the Service type Set Attribute Single and create a source element where the parameter value can be defined.

The Source Length should match the Data type size of the parameter. The Data type can be seen by the factory settings in the Operating Instruction.



Explicit messages with RS Logix 5000

Parameter range:	Class:
Group 0-00 - 0-99 Operation & Display	Class 100 (64 Hex)
Group 1-00 - 1-99 Load & Motor	Class 101 (65 Hex)
Group 2-00 - 2-99 Brakes	Class 102 (66 Hex)
Group 3-00 - 3-99 Reference / Ramps	Class 103 (67 Hex)
Group 4-00 - 4-99 Limits / Warnings	Class 104 (68 Hex)
Group 5-00 - 5-99 Digital In / Out	Class 105 (69 Hex)
Group 6-00 - 6-99 Analog In / Out	Class 106 (6A Hex)
Group 7-00 - 7-99 Controls	Class 107 (6B Hex)
Group 8-00 - 8-99 Comm. and Options	Class 108 (6C Hex)
Group 10-00 - 10-99 Can Fieldbus	Class 110 (6E Hex)
Group 13-00 - 13-99 Smart Logic	Class 113 (71 Hex)
Group 14-00 - 14-99 Special Functions	Class 114 (72 Hex)
Group 15-00 - 15-99 Drive Information	Class 115 (73 Hex)
Group 16-00 - 16-99 Data Readouts	Class 116 (74 Hex)
Group 17-00 - 17-99 Motor Feedback Option	Class 117 (75 Hex)

Instance Description:
In the Danfoss FC 300 Series we only handle Instance 1, so always leave this at the value of 1.

Attribute Description:
The attribute for the FC 300 parameters are the 2 (two) last digits of the Parameter + 100.
By following this structure all 1 dimensional parameters can be accessed by Explicit Message.

As example for Parameter 1662,

FC 300 Parameter	Class	Instance	Attribute
16-62	116	1	162