

Danfoss Ethernet Master

Quick Guide



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Introduction

The Danfoss Ethernet Master operates between a network of VLT frequency converters and an ethernet network.

The Ethernet Master act as a gateway between the build-in FC bus and Ethernet.

One Danfoss Ethernet Master is able to control up to 16 drives.

The Ethernet Gateway is compatible with a broad range of Danfoss VLT's:

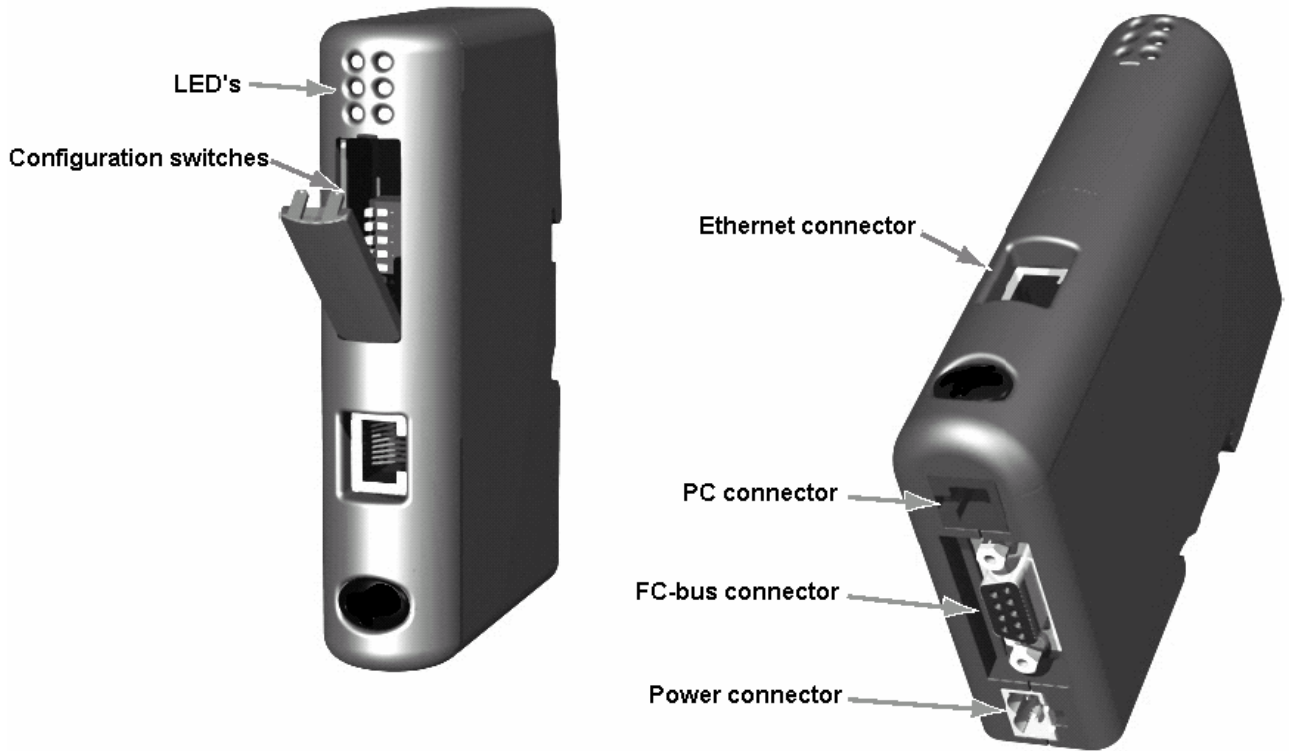
- VLT 2800
- VLT 5000
- VLT 5000 Flux
- VLT 6000
- VLT 8000
- FCD 300
- FCM
- FC 300

The gateway is prepared for communication with PLC-masters, running Modbus TCP or Ethernet/IP.

A transparent TCP socket channel allows users customise their communication, building telegrams for both process data and parameter access.

The Ethernet Master has a build-in WEB-server that allows users to access parameter data, process data and diagnosis information via a standard web-browser.

Product overview



Configuration switches: Used for setting IP address.
(see section: Ethernet Configuration)

Ethernet connector: 10/100 Mbps screened RJ-45 connector.

PC connector: Not used.

FC-bus connector: Female D-SUB 9 Connector for FC-bus.

Pin	Description
1	+ 5V DC
5	Ground
8	RC485 +
9	RC485 -

Power connector:

Pin	Description
1	+ 24V DC +/- 10%
2	Ground

Note:

Use 60/75 or 75°C copper (CU) wire only.
The terminal tightening torque should be 5-7 lbs-in.

Product overview



LED's

LED no.	Description	Indication	Status
1	Module status	Off Steady green Flashing green Flashing red Steady red Flashing green/red	No power Device operational Standby Minor fault Major fault Self test
2	Network status	Off Steady green Flashing green Flashing red Steady red Flashing green/red	No power or no IP address Connected No connections Connection timeout Duplicate IP detected Self test
3	Link	Steady green when connected to an Ethernet network.	
4	Activity	Flashes green each time a packet is received or transmitted.	
5	Transparent channel	Off Flashing green Flashing red	No communication Transparent channel active Transparent channel timeout
6	Sub-net status	Steady green Steady red Flashing green Flashing red Flashing red/green	Data exchange Fatal error (power cycle necessary) Searching baudrate/slaves Slave configuration mismatch* Slaves missing in continuous range.

*= Number of slaves configured from PLC is different from number of slaves on the FC-bus.

Ethernet configuration

Before using the Ethernet Master on an Ethernet network, an IP address must be assigned.

An IP address can be assigned by one of the following methods:

- Configurations switches
- ARP-command
- DHCP
- Netbiter tool

The configuration switch provides an easy way to configure the module for intranet use only.

The IP address can be set in the range: 192.168.0.xxx
 Sub-net mask: 255.255.255.0
 Gateway: 0.0.0.0

The switches represents the binary value of the last byte in the IP address. Switch #1 = MSB, #8 = LSB.

Example:

The switches are set to "00010100" (20 decimal)

The IP address of the module will be set to 192.168.0.20

Note:

In order to make the switch setting active, the module must power-cycle.

The ARP command can be performed from any PC connected to the same Ethernet network.

I a command prompt type:

```
arp -s <IP address> <MAC address>  
arp -d <IP address>
```

Where: <IP address> is the desired IP address for the Ethernet Master, and <MAC address> is the MAC-address, which can be found on the left side of the device.

The IP address is then stored in the flash memory of the Ethernet Master.

The `arp -d` command is optional and removes the static route from the PC's ARP table.

Note:

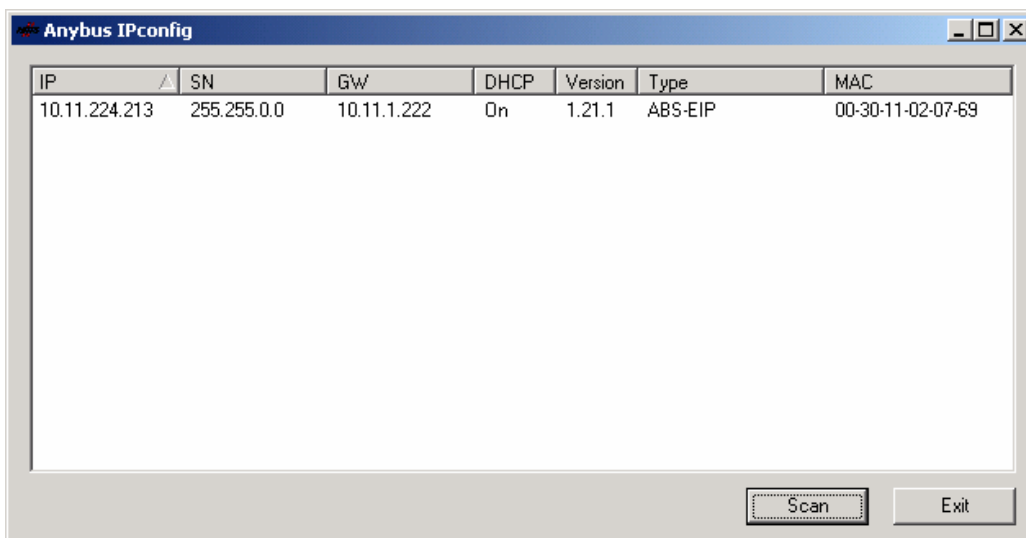
As the ARP command automatically configures the subnet mask to 255.255.255.0, the first three bytes of the IP address must be the same as for the PC executing the command.

The configuration switch must be set to "00000000" in order for the ARP command to function correctly.

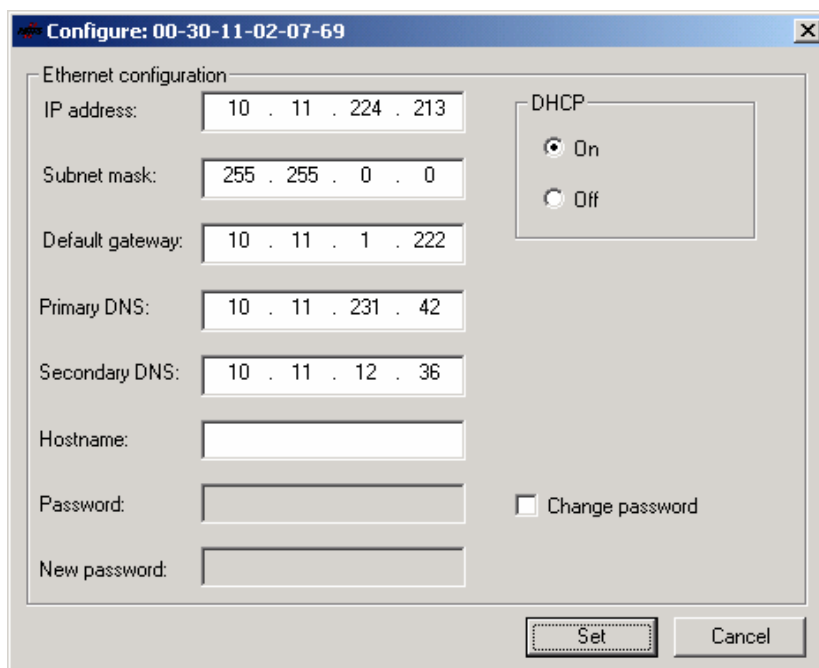
Ethernet configuration

The Anybus IPconfig tool makes it possible to scan the network for connected devices, and to view and assign IP addresses.

The IPconfig tool can be downloaded from: www.danfoss.com/drives



By clicking on the Ethernet Master found, the Ethernet configuration window opens:



In this window all IP settings can be made.

Note:

The configuration switch must be set to "00000000" in order for the Netbiter tool to function correctly.

FC-bus configuration

The FC-bus, or sub-network, is a RS-485 based network where up to 16 VLT's can be connected, in the address range from 2 to 17.

The addressing of the VLT's must be done continuously, and without "holes" in the range.

Example: If 5 VLT's are added, they must be addressed: 2-3-4-5-6.

Note:

Address no. 1 is reserved for new, un-commissioned drives or spare drives.

All VLT's must be set to the same baud-rate, which is auto-detected by the Ethernet Master.

Supported baud-rates are: 1200, 2400, 4800, 9600, 19200, 38400 and 57600 bps.

The character format is fixed to: 8 data bits, even parity, 1 stop bit.

Note:

Please refer to the appropriate instruction manuals on how to set-up FC-bus communication.

The number of drives in the Ethernet Masters polling list, is determined by the setting of bit 0 to 4 in holding register 1025 or Ethernet/IP output word 1.

Bit 0,1,2,3,4	No. of slaves
x,x,x,x,x	Range: 1-17

If the number set is unequal from the actual number of drives on the FC bus, LED 6 will flash red.

The FC-bus has a timeout function which can be set via the configuration word in holding register: 1025, bit 11 to 13.

Bit 13,12,11	Timeout time
0,0,0	1000 ms (default)
0,0,1	10 ms
0,1,0	20 ms
0,1,1	30 ms
1,0,0	50 ms
1,0,1	100 ms
1,1,0	250 ms
1,1,1	500 ms

Note:

Termination switches must be set "ON" at the last VLT on the FC-bus.

WEB interface

The build-in web-server can be accessed from any web-browser by typing in the IP-address of the Ethernet Master:

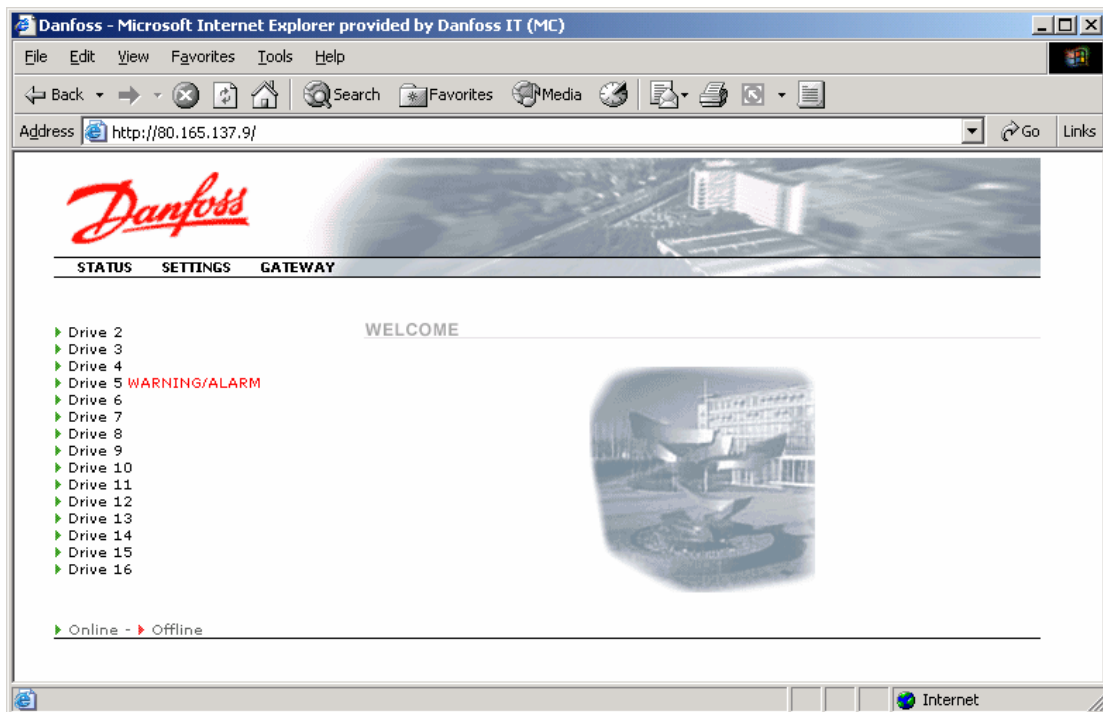
Example: **http://80.165.167.9**

Users will then be prompted for a user name and password.
The default user name and password are:

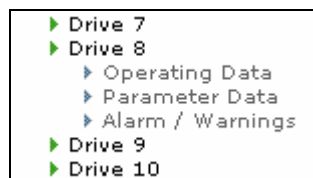
User Name: **user**

Password: **user**

Status page:



On the main status page it is possible to see all drives connected to the Ethernet Master. By clicking on a specific drive a sub-menu opens, allowing the user to select: **Operating Data**, **Parameter Data** and **Alarms/Warnings**.



WEB interface

Operating Data

The Operating Data page displays a detailed view of the actual control- and status word of the drive as well as the bus reference and the actual output frequency.

Parameter Data

The Parameter Data page displays a selected number of parameters.

Alarm / Warnings

The Alarm / Warnings page displays the actual alarm and warning messages of the VLT.

From the main menu it is possible to select the menus: Status, Settings and Gateway. The Status menu is described in the previous section.



Settings

On the Settings page it is possible to change username and password, as well as PLC protocol (ModbusTCP or Ethernet/IP).

Default is: ModbusTCP

It is also possible to change the port number for the transparent socket channel. Default is: 4000.

Gateway

In the Gateway menu, it is possible to read out the software version number of the Ethernet Master.

Memory mapping

Controlword, reference, status word + main actual value.

Ethernet/IP	Modbus holding reg.	Drives -> Gateway	Ethernet/IP	Modbus holding reg.	Gateway -> Drives
Class 04h Instance 64h Attribute 3	1	Reserved	Class 04h Instance 96h Attribute 3	1025	Config. word ²
	2	Status ¹		1026	Reserved
	3	Reserved		1027	Reserved
	4	Reserved		1028	Reserved
	5	STW drive 1		1029	CTW drive 1
	6	MAV drive 1		1030	REF drive 1
	7	STW drive 2		1031	CTW drive 2
	8	MAV drive 2		1032	REF drive 2
	9	STW drive 3		1033	CTW drive 3
	10	MAV drive 3		1034	REF drive 3
	11	STW drive 4		1035	CTW drive 4
	12	MAV drive 4		1036	REF drive 4
	13	STW drive 5		1037	CTW drive 5
	14	MAV drive 5		1038	REF drive 5
	15	STW drive 6		1039	CTW drive 6
	16	MAV drive 6		1040	REF drive 6
	17	STW drive 7		1041	CTW drive 7
	18	MAV drive 7		1042	REF drive 7
	19	STW drive 8		1043	CTW drive 8
	20	MAV drive 8		1044	REF drive 8
	21	STW drive 9		1045	CTW drive 9
	22	MAV drive 9		1046	REF drive 9
	23	STW drive 10		1047	CTW drive 10
	24	MAV drive 10		1048	REF drive 10
	25	STW drive 11		1049	CTW drive 11
	26	MAV drive 11		1050	REF drive 11
	27	STW drive 12		1051	CTW drive 12
	28	MAV drive 12		1052	REF drive 12
	29	STW drive 13		1053	CTW drive 13
	30	MAV drive 13		1054	REF drive 13
	31	STW drive 14		1055	CTW drive 14
	32	MAV drive 14		1056	REF drive 14
	33	STW drive 15		1057	CTW drive 15
	34	MAV drive 15		1058	REF drive 15
	35	STW drive 16		1059	CTW drive 16
	36	MAV drive 16		1060	REF drive 16

¹ = Holding register 2 contains a list of recognized drives, by the Ethernet Master.

Memory mapping

Ethernet Master configuration word

² = Holding register 1025 contains a configuration word for the Ethernet Master:

Bit no:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Func.	T.C.	B.S.	Time out			No. of a-cycl.			Not used			Number of slaves				

Bit 4,3,2,1,0	Number of attached slaves
x,x,x,x,x	Range: 1-17
Bit 7,6,5	Not used
Bit 10,9,8	No. of a-cyclical telegrams pr. timeslot
0,0,0	1 (default)
0,0,1	2
0,1,0	3
0,1,1	4
1,0,0	5
1,0,1	6
1,1,0	7
1,1,1	8
Bit 13,12,11	FC bus timeout time
0,0,0	1000 ms (default)
0,0,1	10 ms
0,1,0	20 ms
0,1,1	30 ms
1,0,0	50 ms
1,0,1	100 ms
1,1,0	250 ms
1,1,1	500 ms
Bit 14 ³	Background scanning: 0=enabled, 1=disabled
Bit 15	Transparent channel: 0=enabled, 1=disabled

³ = The Ethernet Master continuously scans the FC-bus for newly added drives. This background-scanning can be disabled, in order to optimize the polling cycle on the FC-bus. Disabling the background-scanning reduces the FC-polling cycle by approx. 110 ms.

Note:

If the background-scanning is disabled, the Ethernet Master will not automatically recognize new drives.

Memory mapping

Parameter channels.

Ethernet/IP	Modbus holding reg.	Drives -> Gateway
Parameter channel 1		
Class B0h Instance 1h Attribute 1	221	Handshake
	222	Slave index
	223	Resp. PKE
	224	Resp. IND
	225	Resp. PWE high
	226	Resp. PWE low
Parameter channel 2		
Class B0h Instance 1h Attribute 2	227	Handshake
	228	Slave index
	229	Resp. PKE
	230	Resp. IND
	231	Resp. PWE high
	231	Resp. PWE low

Ethernet/IP	Modbus holding reg.	Gateway -> Drives
Parameter channel 1		
Class B1h Instance 1h Attribute 1	1245	Handshake
	1246	Slave index
	1247	Req. PKE
	1248	Req. IND
	1249	Req. PWE high
	1250	Req. PWE low
Parameter channel 2		
Class B1h Instance 1h Attribute 2	1251	Handshake
	1252	Slave index
	1253	Req. PKE
	1254	Req. IND
	1255	Req. PWE high
	1256	Req. PWE low

Setting up Ethernet/IP

In order to set up a Ethernet/IP master (PLC), to communicate via the Ethernet Master, following information is useful:

Identity Object Class 01h:

Vendor ID = 97 (Danfoss)

Device type = 12 (Communication adapter)

Product code = 1

Revision = 1.0 (first released version)

Product name = Ethernet Master

Master setup (I/O data):

Input data:

Input data size: 72 bytes

Input data connection point: 100 (64h)

Output data:

Output data size: 72 bytes

Output data connection point: 150 (96h)

Parameter data:

The parameter access areas are mapped to Class B0h and Class B1h.
See section "Memory mapping" for more information.

Transparent socket channel

The Ethernet Master features an open TCP socket channel where FC protocol telegrams are send transparent from the Ethernet network to the FC-bus, and back. This enables users to build their own telegrams in an custom made application. To set the TCP socket interface port number, please refer to section: WEB Interface. Default is port 4000.

There is added en extra header to the FC-telegram containing transaction ID, data length and a reserved byte.

Byte	Name	Description	
1,2	Transaction ID	Used to match query and response	Extra header
3,4	Data length	Total length of message	
5	Reserved	Reserved for future use	
6	STX	Start of FC message (always=02)	Standard FC-telegram
7	LGE	Length of FC message	
8	ADR	Address of drive (2-17)	
9,10	PKE	PKE word (command and index)	
11,12	IND	Index pointer	
13,14	PWE high	Data high word	
15,16	PWE low	Data low word	
17,18	PCD 1	Process Data word 1	
19,20	PCD 2	Process Data word 2	
21	BCC	Checksum of FC-message	

For additional information on the FC protocol please consult the appropriate Design Guide.

Note:

The transparent channel can be disabled by setting bit 15 in the config-word.

All transparent channel communications is performed a-cyclically on the FC-bus. A-cyclic communication is executed parallel with the cyclic communication.

To fine-tune the timing and priority between cyclic and a-cyclic telegrams, bit 8,9 and 10 in the configuration word in holding register 1025 is used:

Bit 10,9,8	Number of a-cyclical telegrams pr. timeslot
0,0,0	1 (default)
0,0,1	2
0,1,0	3
0,1,1	4
1,0,0	5
1,0,1	6
1,1,0	7
1,1,1	8

Trouble shooting

- Ethernet Master does not recognize any drives on the FC-bus.

Check that the baud-rate are set equally on all drives.

- First drive is not recognized by the Ethernet Master.

Check that the addressing range starts at 2.

- LED 6 flashes red.

Number of drives configured by PLC master is different from number of drives recognized by Ethernet Master. Check configuration word in holding reg. 1025 bit. 0 to 4.

- All drives displayed as off-line in WEB-browser.

You might be accessing the Ethernet Master via a firewall.

The applets in the WEB-interface uses TCP-port 502 (ModbusTCP).

Make sure that your firewall doesn't block for traffic on port 502.

- LED 6 flashes red/green.

The address-range is not continuous, i.e. there is "holes" in the range.

Technical specifications

Mechanical

- Plastic housing with snap-on connection to DIN-rail, protection class IP20.

Dimensions

- 120 mm x 75 mm x 27 mm, L x W x H
- (inches: 4,72" x 2,95" x 1,06"; L x W x H)

Electrical Characteristics

- Power Supply: 24V \pm 10%.
- Maximum power consumption is 280 mA on 24V.
- Typically approx. 100 mA.

Environmental

- Relative Humidity: 0 to 95% non-condensing.
- Temperature: Operating: -5°C to +55°C.
Non Operating: -55°C to +85°C

EMC compliance

- CE mark certified according to European standards unless otherwise is stated.
- Emission: According to EN 50081-2:1993
- Immunity: According to EN 61000-6-2:1999

UL/c-UL compliance

This unit is open type listed by the Underwriters Laboratories. The certificate is valid when the unit is installed in a switch cabinet or equivalent.

The certification has been documented by UL in file E214107.