FREQUENCY INVERTER
FOR INTERFERENCE-FREE, QUIET AND DEPENDABLE MOTOR CONTROL

NFO Sinus® G2

User Guide NFO Sinus

Communication supplement

Ver 2.03

NFO DRIVES

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1 Preface

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2 References

1	NFO Sinus Operating and installation manual 0.37 – 15 kW 400V	NFO
2	MODBUS over Serial Line Specification and Implementation Guide V1.02	Modbus-IDA
3	MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b	Modbus-IDA
4	Profile Drive Technology PROFIdrive Technical Specification for PROFIBUS and PROFINET V4.1	PI International
5	Design Appendix, Anybus CompactCom Drive Profile	HMS

3 Document History

Ver	Date	Change description
2.0	11-05-27	First preliminary version. Made as a merge of earlier version of the Fieldbus supplement and the Serial interface Manual. Starts at V2.0 to not confuse with the old document.
2.01	11-06-30	Added information for NFO Classic protocol and CANopen
2.02	12-11-21	Added information for PROFIBUS (Ch 6.3), Chapter 7 & 8. Changes in CANopen (Ch 6.4)
2.03	13-02-20	5.2 added information on manual takeover from fieldbus control. 6. Added Energy counters and "Short C" parameters in tables for all buses. 7.2. Table 18. Added command for reset of kWh-counter.

4 Introduction

This user guide is a supplement to the regular operating and installation manual for the NFO Sinus inverter. It deals with the installation, configuration and management of the inverters communications interface. It also describes how to address parameters and run motors using different fieldbus protocols.

This version (V2.03) of the document applies to NFO Sinus inverters, shipped with firmware version 4.28 or later.

As standard NFO Sinus handles the MODBUS protocol as well as a home made protocol used by earlier versions of NFO Sinus, in this document referred to as the "Classic NFO serial protocol".

Communication with other buses is solved by installing fieldbus modules from HMS Industrial Networks AB. Some information in this guide, is copied from HMS documentation.

Other than for the Classic NFO serial protocol, this document does not describe the low level communication of any fieldbus, since it follows the standard for each bus and is therefore outside the scope of this document.

Regardless of fieldbus type, NFO Sinus control works in the same way. In case HMS provides a dedicated Drive Profile module for the fieldbus used, this will be the first choice. Drive profile modules uses a generic state machine, implemented in the inverter for control of the inverter. If a module without drive profile or if one of the built-in protocols is used, this state machine can be used as it is made directly accessible through parameters. The description for this, in chapter 7.1, is copied from HMS documentation.

Besides the state machine control, there is also the possibility to control the inverter through the serial interface command parameter SCMD, regardless of fieldbus type.

In case a Drive Profile module is used, the access of the inverter through that profile is not described in this document, as that follows the standard for that particular bus. In this case limitations of the Drive Profile access, specific for NFO Sinus, is described as well as functionality and parameter access not covered by the Drive Profile.

For backward compatibility reasons, there is also the possibility to transfer command, status, set-point and actual values for speed following the "PROFIBUS Profile for variable speed drives, PROFIDRIVE Version 2 / September 1997, PPO 3", regardless of fieldbus type. This however, is not recommended for new installations.

5 Basic fieldbus type independent information

5.1 Physical connection

MODBUS protocol as well as the Classic NFO serial protocol is included in the inverter firmware and uses the inverters serial ports as described in this chapter. For other buses, the fieldbus module is connected to the inverters RS232 RJ45 port. The fieldbus connector is located at the bottom of the inverter housing for IP20 cases and inside the lower front panel for IP54 cases. Next to the fieldbus connector are normally two status LEDs. The function of these differs depending on bus type and are described in chapter 6.

Physically, the serial interface connection is either 2-wire RS485 on screw terminals or RS232 on RJ45 connector. Choice between the two is made through jumper S5 next to the RJ45 connector. Left position (factory default) selects RS232, right position selects RS485.

For RS485, neither line termination nor line biasing is offered by the inverter hardware. If the inverter is placed at the end of the trunk cable, one can terminate the line by connecting a 150 ohm / 0,5 W resistor or a 120 ohm / 0,25 W resistor in serial with a 1 nF / 10V capacitor over the line at the screw terminals of the inverter. Note that there should never be more than one termination at each end of the trunk.

Table 1 shows how to connect the serial interfaces.

RS485	
Signal	Screw Terminal
D0/A	29
D1/B	18
Common	21,22,23,24

RS232	
Signal (DTE)	RJ45 connector
TXD/out	7
RXD/in	8
Common	5

Table 1: Physical Connection.

For RS485, Common is floating (not directly connected to protective ground). To accomplish this jumper S4 (lower left side of the screw terminals) could be connected. For RS232, Common is always connected to protective ground.

Note that for RS232, the pinning of the RJ45 connector does **NOT** follow the MODBUS standard. This is for backwards compatibility reasons.

If needed, NFO Drives AB provides a male RJ45 to female D-sub cable with standard DCE pinning at the D-sub end, suitable for connection (for example) directly to the COM-port of a PC or to a standard RS232-to-USB dongle.

A windows program for easy parametrisation and control of the inverter through either the Classic NFO serial protocol or MODBUS is offered for free download at http://www.nfo.se.

5.2 Basic control

Fieldbus control is entered/left through commands on the bus. When in fieldbus control, the display shows inverter status starting with 'Bus', for example 'Bus Run' or 'BusStby', depending on whether motor output is activated or not.

Fieldbus control can be cancelled by pressing <STOP> on the inverter keypad, this will release a running motor, whereupon inverter goes to local mode, showing status 'Stop' on the display. However, fieldbus control can in this case be regained through command on the bus or on demand from the fieldbus module. In some situation the fieldbus module won't accept manual takeover and regain control immediately after <STOP> is pressed. In theses cases one will have to physically disconnect the module from the RJ45 connector in order to be able to run the motor from the keypad or any other interface.

In order to run motor from the fieldbus the digital input RUN has to be active. A fieldbus controlled running motor can always be stopped by deactivating the RUN input.

If fieldbus control is intended and therefore the RUN input is constantly held active the parameter 'AutoStart' in parameter group 'Control' should be turned OFF to avoid start of motor at power up, before the fieldbus has taken control of the inverter.

Information on how to set parameters from the inverter keypad and how to activate digital inputs is given in the ordinary operating and installation manual.

5.3 Parameter group 'Serial'

Fieldbus specific parameters are found in the parametergroup 'serial'. Some parameters have different ranges depending on fieldbus type or have no meaning for some buses as the behaviour is strictly specified. In case the range is bus specific, a more detailed description is given in chapter 6.

5.3.1 Parameter 'BusType'

To allow fieldbus control of the inverter, the parameter 'BusType' has to be set to desired fieldbus type. As default (for backward compatibility reasons), if no fieldbus module is included, the classic NFO serial protocol is chosen. The parameter can be changed according to the following :

'NFO'	Classic NFO serial protocol (default)
'MbusRtu'	Modbus RTU
'MbusAsc'	Modbus ASCII
'ABCC'	Used when a fieldbus module is inserted after delivery. If this value is set, the correct fieldbus will automatically be chosen after reboot of the inverter. After this the parameter will be 'read only' as long as the module is connected and functional.
'None'	All fieldbus communication is disabled.

In case the inverter is delivered including a fieldbus module, the parameter is 'read only' showing the name of the fieldbus. If the fieldbus module is disconnected (modular cable inside lower front panel) or becomes inoperable for some other reason, the parameter will leave the 'read only' state to accept values as described above.

5.3.2 Parameters 'Address', 'SiBaud' & SiProt

Network address, Communication speed & Character setup.

Valid ranges and usage depends on fieldbus type, see chapter 6 for more details.

5.3.3 Parameter 'SiTot'

Network time-out. **TBD**

5.3.4 Parameter 'Auto Reset'

If set to 'OFF' (default), any change of 'Address', 'SiBaud' or 'SiProt' will not take effect until after next reboot (power on) of the inverter.

If set to 'ON', any change of 'Address', 'SiBaud' or 'SiProt' will trigger a reinitialisation of the fieldbus in order for the new value to take immediate effect.

5.3.5 Parameter 'Auto Stop'

If enabled (ON), motor stops at fieldbus communication failure, for example if the network cable is disconnected. Otherwise the motor will continue to run at the last received setpoint speed.

TBD

6 Fieldbus specific Information

6.1 Classic NFO serial protocol

6.1.1 General

As this protocol is a home made product of NFO Drives, it is described in detail in this document.

The physical connection is the same as used for MODBUS and is described in chapter 5.1.

6.1.2 Comm settings parameter group 'Serial'

Parameter 'Address' sets the slave Id to which the inverter will respond. Valid range is 1 to 94.

Parameter 'SiBaud' sets the transmission speed. Available baudrates are 1200, 2400, 4800, 9600, 19200, 38400 and 57600 b/s. Default is 9600.

Parameter 'SiProt' specifies the character coding.
The Classic NFO serial protocol always uses one start bit.
The number of data bits is 7 or 8, default is 7.
Parity is Even Odd or No parity, default is Even.
In case of No parity, two stop bits are used otherwise one.

Note: Changes of the parameters Adress, SiBaud & SiProt will not take effect until next power on, unless parameter Auto Reset is ON.

6.1.3 Messages

The inverter recognises two types of messages:
ENQUIRY, a question, asking for the value of a parameter.
SELECT, command specifying new value of a parameter.

The inverter responds by three different types of messages:
REPLY, a response containing the current value of a parameter.
ACK, acknowledge.
NAK, not acknowledge.

The five different message types, assembled by data fields, are described below. After that, each field is described individually. All are based on ASCII characters.

ENQUIRY:

EOT	ADR	PARAMETER	ENQ

SELECT:

EOT	ADR	STX	PARAMETER	=	VALUE	ETX	BCC

REPLY:

ADR	STX	PARAMETER	=	VALUE	ETX	BCC

ACK:

ADR	ACK

NAK:

ADR	NAK

EOT	Control character "End-Of-Transmission" code 4 (04H)
ENQ	Control character "ENQuiry" code 5 (05H)
STX	Control character "Start-of-TeXt" code 2 (02H)
ETX	Control character "End-of-TeXt" code 3 (03H)
ACK	Control character "ACKnowledge" code 6 (06H)
NAK	Control character "Not-AcKnowledge" code 21 (15H)
=	Equals sign code 61 (3DH)
ADR	Inverter address. One character, coded by adding 32 to the address. Valid addresses are 0 to 95. Code 32 (20H) to 127 (7FH).
PARAMETER	Parameter address Five characters which identify the parameter. The first character is a prefix, which is the same for all parameters. The parameter prefix is followed by a four position hexadecimal number.
VALUE	Parameter value Four characters, hexadecimal number gives the value range -32768 (8000H) to +32767 (7FFFH). Sent as ASCII characters.
BCC	Check sum. One character calculated with the XOR function from all characters, starting with the character after STX, to (and including) ETX.

Example
A SELECT message to address 1 which gives parameter 25 the value of 100 has the following appearance:
04H 21H 02H 45H 30H 30H 31H 39H 3DH 30H 30H 36H 34H 03H 71H

6.1.4 Message Flow

The inverter never sends messages on its own initiative, only as the answer to incoming messages.

The inverter ignores incoming messages with parity faults or incorrect checksum. Answers are only given to ENQUIRY and SELECT messages with correct addresses.

The address of the inverter is in the interval from 1 to 94. Address 0 is reserved for point-to-point communication. All inverters, irrespective of programmed address, answer to point-to-point messages. Address 0 may only be used if only one inverter is connected to a host computer. Address 95 is used to send SELECT messages at the same time to all connected inverters (broadcast). When an inverter receives a SELECT message with address 95, it obeys the command, irrespective of programmed address, but does not send a return message.

A correctly received ENQUIRY message is answered by a REPLY message, containing the current value of the relevant parameter. If the ENQUIRY message contains an invalid parameter, this is answered by NAK.

SELECT messages are answered by ACK if the parameter is valid, the value is within limits and the specified command is permissible at current program status, otherwise NAK.

6.1.5 Error Handling

If any fault occurs, the motor will be stopped and it will not be possible to re-start until the fault has been mended and acknowledged. On the serial channel, this means that no commands can be executed. All SELECT messages will be answered by NAK. ENQUIRY messages are answered as usual. The error cause is indicated by the inverter status. The current inverter status is displayed with text in the inverter display and as a value in the inverter status parameter, readable through the serial interface. Acknowledging can be done via the keypad or by reading inverter status via an ENQUIRE message on the serial channel. It is also possible to read the status without acknowledge of any errors through a different parameter.

If a serial channel fault occurs, a fault flag is set, which specifies the type of fault. When a fault flag has been set, the inverter status will specify a serial fault on condition that the fault occurred during control from the serial channel. The serial interface fault flags are collected in a separate parameter and are collectively zeroed by reading this parameter via an ENQUIRE message on the serial channel.

There is one exception from the above. If the inverter receives a SELECT/MODE/STOP-message, it will be executed even if a serial fault is present. Additionally, in this case, the serial fault will be acknowledged and all serial fault flags will be reset.

When a serial channel fault occurs during motor control or parameter manipulation through the serial interface or because of a manual take-over at the keypad, also the serial interface mode will be changed. The serial interface mode is read/writable through the serial interface.

When a SELECT message is responded by NAK, the first measure should be to read/acknowledge the inverter status to determine the reason for the NAK. If the inverter status indicates serial interface fault, the serial interface fault flags also has to be read/acknowledged.

It is possible to use a time-out function as a protection against interruptions in serial communication. When this function is used, new messages must arrive on the serial channel periodically, within a specified time-out time. If the time-out time is exceeded, this is interpreted as a serial channel fault. The time-out time is specified by a parameter. Setting the time-out time to 0 will disable the time-out function.

Serial channel faults can not be acknowledged from the keypad, and do not affect control of the inverter from other sources than the serial channel.

6.1.6 User interface Parameters

Table 2 shows parameters available from the keypad/display of NFO Sinus and their addresses. The table is organized in groups, in the same way and order as they appears on the display. For a more detailed description of each parameter (for example usage, range and read/right capabilities), See the NFO Sinus Operation and Installation manual.

Name	Parameter	Type	Scaling/Coding
Parameter group Motor			
P-Nom	E0008	SINT16	kW/10^2
U-Nom	E0009	SINT16	V
f-Nom	E000F	SINT16	Hz
N-nom	E0010	SINT16	rpm
I-nom	E0011	SINT16	A/10^1
cos-φ	E0015	SINT16	1/10^2
Tuning	See parameter SCMD, chapter 6.1.7 & 7.2		
R-stat	E0002	SINT16	Ω/10^2
R-rot	E0001	SINT16	Ω/10^2
L-main	E0004	SINT16	H/10^4
Sigma	E0003	SINT16	1/10^3
I-magn	E0005	SINT16	A/10^2
I-limt	E0018	SINT16	A/10^2
Parameter group Control			
Mode	E0030	ENUM	0 = Freque 1 = PI-Reg 2 = Torque 3 = Speed
Accel	E001D	SINT16	s/10^1
Retard	E001C	SINT16	s/10^1
RunDly	E002C	SINT16	s
DC-Brk	E0088	SINT16	s
AinSet	E0098	ENUM	3 = 0-20mA 4 = 4-20mA 5 = +/-20mA 6 = 0-10V 7 = 2-10V 8 = +/-10V 9 = Pot 10k

Name	Parameter	Type	Scaling/Coding
AutoStart	E0033	ENUM	0 = OFF 1 = ON
EnergySave	E00BB	ENUM	0 = OFF 1 = ON
StMode	E0032	ENUM	0 = Release 1 = Brake
Kp-spd	E0006	SINT16	$1/10^2$
Ti-spd	E0017	SINT16	$s/10^2$
FSleep	E00DC	SINT16	Hz/FrqScl, see ch 8.3.1
Byp-fr	E0051	SINT16	Hz/FrqScl, see ch 8.3.1
Byp-bw	E0050	SINT16	Hz/FrqScl, see ch 8.3.1
AnyBus	E0038	ENUM	3 = PPO3 (Obsolete from FW Ver 4.28)
Parameter group Freque			
OpMode	E0031	ENUM	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R
F-fix1	E0041	SINT16	Hz/FrqScl, see ch 8.3.1
F-fix2	E0042	SINT16	Hz/FrqScl, see ch 8.3.1
F-fix3	E0043	SINT16	Hz/FrqScl, see ch 8.3.1
F-fix4	E0044	SINT16	Hz/FrqScl, see ch 8.3.1
F-fix5	E0045	SINT16	Hz/FrqScl, see ch 8.3.1
F-fix6	E0046	SINT16	Hz/FrqScl, see ch 8.3.1
F-fix7	E0047	SINT16	Hz/FrqScl, see ch 8.3.1
Fr-min	E000D	SINT16	Hz/FrqScl, see ch 8.3.1
Fr-max	E000B	SINT16	Hz/FrqScl, see ch 8.3.1
Parameter group Speed			

Name	Parameter	Type	Scaling/Coding
OpMode	E0089	ENUM	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6 R 003Dh = Fix-7 R
C-fix1	E008A	SINT16	rpm/SpdScl, see ch 8.3.2
C-fix2	E008B	SINT16	rpm/SpdScl, see ch 8.3.2
C-fix3	E008C	SINT16	rpm/SpdScl, see ch 8.3.2
C-fix4	E008D	SINT16	rpm/SpdScl, see ch 8.3.2
C-fix5	E008E	SINT16	rpm/SpdScl, see ch 8.3.2
C-fix6	E008F	SINT16	rpm/SpdScl, see ch 8.3.2
C-fix7	E0090	SINT16	rpm/SpdScl, see ch 8.3.2
Sp-min	E0091	SINT16	rpm/SpdScl, see ch 8.3.2
Sp-max	E0092	SINT16	rpm/SpdScl, see ch 8.3.2
Parameter group Torque			
OpMode	E0035	ENUM	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R
T-fix1	E0061	SINT16	Nm/TrqScl, see ch 8.3.3
T-fix2	E0062	SINT16	Nm/TrqScl, see ch 8.3.3
T-fix3	E0063	SINT16	Nm/TrqScl, see ch 8.3.3
T-fix4	E0064	SINT16	Nm/TrqScl, see ch 8.3.3
T-fix5	E0065	SINT16	Nm/TrqScl, see ch 8.3.3
T-fix6	E0066	SINT16	Nm/TrqScl, see ch 8.3.3
T-fix7	E0067	SINT16	Nm/TrqScl, see ch 8.3.3
Tq-min	E000E	SINT16	Nm/TrqScl, see ch 8.3.3
Tq-max	E000C	SINT16	Nm/TrqScl, see ch 8.3.3
Max-fr	E0026	SINT16	Hz/FrqScl, see ch 8.3.1
Parameter group PI Reg			

Name	Parameter	Type	Scaling/Coding
OpMode	E0036	ENUM	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R 0102h = Temp F 0103h = Temp R
R-fix1	E0039	SINT16	Unit/10^{1*}
R-fix2	E003A	SINT16	Unit/10^{1*}
R-fix3	E003B	SINT16	Unit/10^{1*}
R-fix4	E003C	SINT16	Unit/10^{1*}
R-fix5	E003D	SINT16	Unit/10^{1*}
R-fix6	E003E	SINT16	Unit/10^{1*}
R-fix7	E003F	SINT16	Unit/10^{1*}
Setmin	E004B	SINT16	Unit/10^{1*}
Setmax	E004C	SINT16	Unit/10^{1*}
Actmin	E009A	SINT16	Unit/10^{1*}
Actmax	E009B	SINT16	Unit/10^{1*}
T-min	E0049	SINT16	°C
T-max	E004A	SINT16	°C
RegAmp	E0052	ENUM	-1 or 1
RegKp	E0040	SINT16	$1/10^{2}$
RegTi	E0048	SINT16	s/10^{1}
Min-fr	E009E	SINT16	Hz/FrqScl, see ch 8.3.1
Max-fr	E0025	SINT16	Hz/FrqScl, see ch 8.3.1
Unit	E000A	ENUM	0 = None 1 = Pa 2 = kPa 3 = bar 4 = rpm 5 = m^3/s 6 = l/s 7 = m^3/h 8 = l/h 9 = ppm 10 = % 11 = V 12 = Hz
AinAct	E0034	ENUM	0 = 0-10V 1 = 2-10V 2 = +/-10V
Parameter group Output			

Name	Parameter	Type	Scaling/Coding
ReMode	E0059	ENUM	0 = Disable 1 = Freque 2 = Run Fwd 3 = Run Rev 4 = Run Setp 5 = Run Freq
ReFreq	E005A	SINT16	Hz/FrqScl, see ch 8.3.1
V-Out	E005B	ENUM	0 = Disable 1 = Freque 2 = Speed 3 = Torque
V-Max	E005C	UINT16	$V/10^2$
F-Out	E005D	ENUM	0 = Disable 1 = Freque 2 = Speed 3 = Torque
F-Max	E005E	UINT16	Hz
Parameter group Serial			
BusType	E007A	ENUM	0 = None 1 = NFO 2 = MbusAsc 3 = MbusRtu 4 = ABCC
Adress	E00A9	SINT16	
SiBaud	E00A8	ENUM	16 = 1200bps 32 = 2400bps 64 = 4800bps 128 = 9600bps 256 = 19200bps 512 = 38400 bps 768 = 57600 bps
SiProt	E00AA	ENUM	0 = 7b Ep 1s 1 = 7b Op 1s 2 = 7b Np 2s 4 = 8b Ep 1s 5 = 8b Op 1 6 = 8b Np 2s
SioTot	E00AB	SINT16	$s/10^1$
AutoReset	E002F	ENUM	0 = OFF 1 = ON
AutoStop	E00D8	ENUM	0 = OFF 1 = ON
Parameter group Status			
U-rms	E00DA	SINT16	V
I-rms	E0095	SINT16	$A/10^2$
P-out	E00D9	SINT16	W
PF	E00DB	SINT16	$1/10^2$
DCLink	E0014	SINT16	$V/10^1$
FrqSet	E0020	SINT16	Hz/FrqScl, see ch 8.3.1
FrqAct	E00B6	SINT16	Hz/FrqScl, see ch 8.3.1
SpdSet	E0096	SINT16	rpm/SpdScl, see ch 8.3.2
SpdAct	E0094	SINT16	rpm/SpdScl, see ch 8.3.2
TrqSet	E0021	SINT16	Nm/TrqScl, see ch 8.3.3
TrqAct	E0097	SINT16	Nm/TrqScl, see ch 8.3.3
RegSet	E004E	SINT16	$Unit/10^{1*}$
RegAct	E004F	SINT16	$Unit/10^{1*}$
PT1000	E004D	SINT16	$°C/10^1$

Name	Parameter	Type	Scaling/Coding
M-Temp	E0058	SINT16	%/10^1 ($1/10^3$)
OpTime	E0027, E0127	SINT32	h/10^1
RnTime	E0028, E0128	SINT32	h/10^1
BrTime	E00DD, E00DE	SINT32	s
E-Out	E00FA, E00FB	SINT32	KWh/10^3 (Available from FW 4.38)
∑E-Out	E00FC, E00FD	SINT32	MWh/10^3 (Available from FW 4.38)
Parameter group Error			
E-logg 1	E0200, E0201	32 * UIN32	See Chapter ...
Elogg 2	E0202, E0203		
….	….		
Elogg 31	E023C, E023D		
Elogg 32	E023E, E023F		
RstDly	E002A	SINT16	s
TrTime	E002B	SINT16	s
AC Fail/AC Err	E0037	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
AC Fail/Delay	E00A0	SINT16	s/10^1
AC Fail/ErrCnt	E00A1	SINT16	
AC Fail/IT-Gnd	E00B9	ENUM	0 = OFF 1 = ON
Temp Hi/ErrCnt	E009F	SINT16	
PTC Temp/PTCTmp	E001B	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
PTC Temp/ErrCnt	E0072	SINT16	
OverLoad/OverLd	E0055	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
OverLoad/ErrCnt	E00B7	SINT16	
OverLoad/F-Cool	E0056	SINT16	
OverLoad/S-Temp	E0057	SINT16	°C
Ain Fail/AinErr	E005F	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
AinFail/ErrCnt	E00A2	SINT16	
DC Low/ErrCnt	E0022	SINT16	
DC High/ErrCnt	E0023	SINT16	
GND Fail/GndErr	E00A3	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Short C/ErrCnt	E00F9	SINT16	(Available from FW 4.32)
ImagnLow/ImagLow	E00A4	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
ImagnLow/ErrCnt	E00A5	SINT16	
Cur Low/Cur Low	E00A6	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Cur Low/ErrCnt	E00A7	SINT16	

Name	Parameter	Type	Scaling/Coding
Cur High/CurHigh	E00B2	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Cur High/Delay	E00B5	SINT16	s/10[1]
Cur High/ErrCnt	E00B3	SINT16	
Run Fail/RunFail	E002E	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Run Fail/ErrCnt	E00AF	SINT16	

Table 2: User interface parameters.

6.1.7 Fieldbus Control Parameters

Table 3 shows parameters used for fieldbus control. The table gives Name, address and type of the parameters. The usage and coding of these parameters is not fieldbus specific and is described in detail in chapter 7.

Name	Register	Type	Scaling/Coding
SW Ver	E0075	UINT16	1/10[2]
NFOVer	E0076	UINT16	1
Inv St (With Ack)	E00E8	ENUM	See Chapter 8.2
Inv St (Without Ack)	E00E9	ENUM	
SioErr	E00AC	UINT16	
DrvCtrl Write Mask	***TBD*** (AND)	2 * UINT16	See Chapter 7.1
	TBD (OR)		
DriveControl	E007C	UINT16	
DriveStatus	E007D	UINT16	
MODE	E0029	ENUM	See Chapter 7.2
SCMD	E00AD	ENUM	
ProfidriveControl	**TBD**	UINT16	See Chapter 7.3
ProfidriveStatus	**TBD**	UINT16	
FrqScl Numerator	**TBD**	SINT32	FrqScl = Numerator/Denominator Default 1/10[1], see ch 8.3.1.
FrqScl Denominator	**TBD**	SINT32	
SpdScl Numerator	E00E2, E00E1	SINT32	SpdScl = Numerator/Denominator Default 1, see ch 8.3.2
SpdScl Denominator	E00E4, E00E3	SINT32	
TrqScl Numerator	**TBD**	SINT32	TrqScl = Numerator/Denominator Default T-nom/10[2], see ch 8.3.3.
TrqScl Denominator	**TBD**	SINT32	
RegScl Numerator	**TBD**	SINT32	RegScl = Numerator/Denominator Default 1/10[1], see ch 8.3.4.
RegScl Denominator	**TBD**	SINT32	

Setpoint	E001E	SINT16	When using this parameter the value is redirected to/from one of the parameters FrqSet, SpdSet, TrqSet or RegSet depending on the current value of Control/Mode (E0030).
FrqSet	E0020	SINT16	Hz/FrqScl, see ch 8.3.1
SpdSet	E0096	SINT16	rpm/SpdScl, see ch 8.3.2
TrqSet	E0021	SINT16	Nm/TrqScl, see ch 8.3.3
RegSet	E004E	SINT16	Unit/RegScl, see ch 8.3.4

Table 3: Fieldbus Control Parameters

6.2 MODBUS

6.2.1 General

With some restrictions, the MODBUS implementation of NFO Sinus strictly follows the standards "MODBUS over Serial Line Specification and Implementation Guide V1.02" and "MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b". Both available for download at http://www.Modbus-IDA.org.

The information in this document concentrates on the restrictions of the MODBUS implementation together with information on how to access parameters in, and control the motor connected to the NFO Sinus inverter.

The physical connection is the same as used for the classic NFO serial protocol and is described in chapter 5.1.

6.2.2 Communication settings, parameter group 'Serial'

Both transmission modes, RTU and ASCII, are supported. Selection between the two is made through parameter 'BusType'.

Parameter 'Address' sets the MODBUS slave address to which the inverter will respond. Valid range is 1 to 247. Default is 1.

Parameter 'SiBaud' sets the transmission speed. Available baudrates are 1200, 2400, 4800, 9600, 19200, 38400 and 57600 b/s. Default is 19200.

Parameter 'SiProt' specifies the character coding.
MODBUS always uses one start bit.
The number of data bits depends on transmission mode. RTU uses 8, ASCII 7 bits.
One can chose between Even Odd or No parity. Default is Even.
In case of No parity, two stop bits are used otherwise one.

Note that changes of the parameters Adress, SiBaud & SiProt will not take effect until next power on, unless parameter Auto Reset is ON.

6.2.3 Function Code support for Parameter access

Since all parameter access as well as motor control is made through MODBUS holding registers, any access of Discrete Inputs, Coils or Input Registers is needless and therefore not supported.

A MODBUS holding register is always 16bit. Parameters that takes less or equal to 16 bits of data occupies one register. Longer parameters holds the 16 least significant bits in one register and the second least significant bits in the register directly following (higher address), and so on.

Parameters occupying more than one register has to be read/written in one message.

For parameter access and motor control, the NFO Sinus MODBUS implementation supports the following function codes:

03 Read Holding Registers
06 Write Single Register
16 Write Multiple Registers
23 Read/Write Multiple Registers

6.2.4 Function Code support for device identification

Function Code 43, Encapsulated Interface Transport, offers support for the MEI Type 14, Read Device Identification. Read device ID codes 01 (basic), 02 (regular) and 04 (specific) are supported. Object Id 0x00 through 0x06 holds the following information, in ASCII string format:

0x00 VendorName:	'NFO Drives AB'
0x01 ProductCode:	(empty string **TBD**)
0x02 MajorMinorRevision:	17 char string ex ' 4.30 / 4018 '
0x03 VendorUrl:	'http://www.nfo.se'
0x04 ProductName:	'NFO Sinus'
0x05 ModelName:	8 char string ex '1.50/400'
0x06 UserApplicationName:	(empty string **TBD**)

Function Code 17, Report Slave ID, returns a 16 character ASCII string representing the serial number of the inverter.

6.2.5 User interface Parameters

Table 4 shows parameters available from the keypad/display of NFO Sinus and in which holding registers they are found. The table is organized in groups, in the same way and order as they appears on the display. For a more detailed description of each parameter (for example usage, range and read/right capabilities), See the NFO Sinus Operation and Installation manual.

Name	**Register**	**Type**	**Scaling/Coding**
Parameter group Motor			
P-Nom	0220h, 0221h	UINT32	W (kW/10^3)
U-Nom	0224h	UINT16	V
f-Nom	0228h	UINT16	Hz
N-nom	022Ch	UINT16	rpm

Name	Register	Type	Scaling/Coding
I-nom	0230h, 0231h	UINT32	mA ($A/10^3$)
cos-φ	0234h	UINT16	$1/10^3$
Tuning	See parameter SCMD, chapter 6.2.6 & 7.2		
R-stat	0238h, 0239h	UINT32	mΩ ($Ω/10^3$)
R-rot	023Ch, 023Dh	UINT32	mΩ ($Ω/10^3$)
L-main	0240h, 0241h	UINT32	µH ($H/10^6$)
Sigma	0244h	UINT16	$1/10^3$
I-magn	0248h, 0249h	UINT32	mA ($A/10^3$)
I-limt	024Ch, 024Dh	UINT32	mA ($A/10^3$)
Parameter group Control			
Mode	029Ch	ENUM	0 = Freque 1 = PI-Reg 2 = Torque 3 = Speed
Accel	027Eh, 027Fh	SINT32	ms ($s/10^3$)
Retard	0282h, 0283h	SINT32	ms ($s/10^3$)
RunDly	02BCh	UINT16	s
DC-Brk	02C0h	UINT16	s
AinSet	02C4h	ENUM	3 = 0-20mA 4 = 4-20mA 5 = +/-20mA 6 = 0-10V 7 = 2-10V 8 = +/-10V 9 = Pot 10k
AutoStart	02C8h	ENUM	0 = OFF 1 = ON
EnergySave	02CCh	ENUM	0 = OFF 1 = ON
StMode	0290h	ENUM	0 = Release 1 = Brake
Kp-spd	02D0h	UINT16	$1/10^2$
Ti-spd	02D4h	UINT16	$s/10^2$
FSleep	02D8h	UINT16	Hz/FrqScl, see ch 8.3.1
Byp-fr	02DCh	UINT16	Hz/FrqScl, see ch 8.3.1
Byp-bw	02E0h	UINT16	Hz/FrqScl, see ch 8.3.1

Name	Register	Type	Scaling/Coding
Parameter group Freque			
OpMode	02E4h	ENUM	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R
F-fix1	02E8h	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix2	02ECh	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix3	02F0h	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix4	02F4h	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix5	02F8h	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix6	02FCh	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix7	0300h	UINT16	Hz/FrqScl, see ch 8.3.1
Fr-min	0304h	SINT16	Hz/FrqScl, see ch 8.3.1
Fr-max	0308h	SINT16	Hz/FrqScl, see ch 8.3.1
Parameter group Speed			
OpMode	030Ch	ENUM	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6 R 003Dh = Fix-7 R
C-fix1	0310h	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix2	0314h	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix3	0318h	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix4	031Ch	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix5	0320h	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix6	0324h	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix7	0328h	UINT16	rpm/SpdScl, see ch 8.3.2
Sp-min	032Ch	SINT16	rpm/SpdScl, see ch 8.3.2

Name	Register	Type	Scaling/Coding
Sp-max	0330h	SINT16	rpm/SpdScl, see ch 8.3.2
		Parameter group Torque	
OpMode	0334h	ENUM	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R
T-fix1	0338h	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix2	033Ch	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix3	0340h	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix4	0344h	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix5	0348h	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix6	034Ch	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix7	0350h	UINT16	Nm/TrqScl, see ch 8.3.3
Tq-min	0354h	UINT16	Nm/TrqScl, see ch 8.3.3
Tq-max	0358h	UINT16	Nm/TrqScl, see ch 8.3.3
Max-fr	035Ch	UINT16	Hz/FrqScl, see ch 8.3.1
		Parameter group PI Reg	
OpMode	0360h	ENUM	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R 0102h = Temp F 0103h = Temp R
R-fix1	0364h	SINT16	Unit/10^{1*}
R-fix2	0368h	SINT16	Unit/10^{1*}
R-fix3	036Ch	SINT16	Unit/10^{1*}
R-fix4	0370h	SINT16	Unit/10^{1*}
R-fix5	0374h	SINT16	Unit/10^{1*}
R-fix6	0378h	SINT16	Unit/10^{1*}
R-fix7	037Ch	SINT16	Unit/10^{1*}
Setmin	0380h	SINT16	Unit/10^{1*}
Setmax	0384h	SINT16	Unit/10^{1*}

Name	Register	Type	Scaling/Coding
Actmin	0388h	SINT16	Unit/10^{1*}
Actmax	038Ch	SINT16	Unit/10^{1*}
T-min	0390h	SINT16	°C
T-max	0394h	SINT16	°C
RegAmp	0398h	ENUM	-1 or 1
RegKp	039Ch	UINT16	$1/10^{2}$
RegTi	03A0h	UINT16	$s/10^{1}$
Min-fr	03A4h	UINT16	Hz/FrqScl, see ch 8.3.1
Max-fr	03A8h	UINT16	Hz/FrqScl, see ch 8.3.1
Unit	03ACh	ENUM	0 = None 1 = Pa 2 = kPa 3 = bar 4 = rpm 5 = m^3/s 6 = l/s 7 = m^3/h 8 = l/h 9 = ppm 10 = % 11 = V 12 = Hz
AinAct	03B0h	ENUM	0 = 0-10V 1 = 2-10V 2 = +/-10V
Parameter group Output			
ReMode	03B4h	ENUM	0 = Disable 1 = Freque 2 = Run Fwd 3 = Run Rev 4 = Run Setp 5 = Run Freq
ReFreq	03B8h	UINT16	Hz/FrqScl, see ch 8.3.1
V-Out	03BCh	ENUM	0 = Disable 1 = Freque 2 = Speed 3 = Torque
V-Max	03C0h	UINT16	$V/10^{2}$
F-Out	03C4h	ENUM	0 = Disable 1 = Freque 2 = Speed 3 = Torque
F-Max	03C8h	UINT16	Hz
Parameter group Serial			
BusType	03CCh	ENUM	0 = None 1 = NFO 2 = MbusAsc 3 = MbusRtu 4 = ABCC
Adress	03D0h	UINT16	
SiBaud	03D4h	ENUM	16 = 1200bps 32 = 2400bps 64 = 4800bps 128 = 9600bps 256 = 19200bps 512 = 38400 bps 768 = 57600 bps

Name	Register	Type	Scaling/Coding
SiProt	03D8h	ENUM	0 = 7b Ep 1s 1 = 7b Op 1s 2 = 7b Np 2s 4 = 8b Ep 1s 5 = 8b Op 1 6 = 8b Np 2s
SioTot	03DCh	UINT16	s/10^1
AutoReset	03E0h	ENUM	0 = OFF 1 = ON
AutoStop	03E4h	ENUM	0 = OFF 1 = ON
Parameter group Status			
U-rms	03E8h	SINT16	V
I-rms	03ECh, 03EDh	SINT32	mA (A/10^3)
P-out	03F0h, 03F1h	SINT32	W (kW/10^3)
PF	03F4h	SINT16	1/10^3
DCLink	03F8h	SINT16	V
FrqSet	03FCh	SINT16	Hz/FrqScl, see ch 8.3.1
FrqAct	0400h	SINT16	Hz/FrqScl, see ch 8.3.1
SpdSet	025Ch	SINT16	rpm/SpdScl, see ch 8.3.2
SpdAct	0264h	SINT16	rpm/SpdScl, see ch 8.3.2
TrqSet	0408h	SINT16	Nm/TrqScl, see ch 8.3.3
TrqAct	040Ch	SINT16	Nm/TrqScl, see ch 8.3.3
RegSet	0410h	SINT16	Unit/10^{1*}
RegAct	0414h	SINT16	Unit/10^{1*}
PT1000	0418h	SINT16	°C/10^1
M-Temp	041Ch	SINT16	%/10^1 (1/10^3)
OpTime	02A8h, 02A9h	SINT32	h/10^1
RnTime	02ACh, 02ADh	SINT32	h/10^1
BrTime	0420h, 0421h	SINT32	s
E-Out	05B0h, 05B1h	SINT32	Kwh/10^3 (Available from FW 4.38)
∑E-Out	05B4h, 05B5h	SINT32	Mwh/10^3 (Available from FW 4.38)
Parameter group Error			
E-logg 1	C000h, C001h	32 * UIN32	See Chapter ...
Elogg 2 …. Elogg 31	C004h, C005h …. C078h, C079h		
Elogg 32	C07Ch, C07Dh		
RstDly	0424h	UINT16	s
TrTime	0428h	UINT16	s
AC Fail/AC Err	042Ch	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
AC Fail/Delay	0430h	UINT16	s/10^1
AC Fail/ErrCnt	0434h	UINT16	
AC Fail/IT-Gnd	0438h	ENUM	0 = OFF 1 = ON
Temp Hi/ErrCnt	043Ch	UINT16	
PTC Temp/PTCTmp	0440h	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
PTC Temp/ErrCnt	0444h	UINT16	

Name	Register	Type	Scaling/Coding
OverLoad/OverLd	0448h	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
OverLoad/ErrCnt	044Ch	UINT16	
OverLoad/F-Cool	0450h	UINT16	
OverLoad/S-Temp	0454h	SINT16	°C
Ain Fail/AinErr	0458h	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
AinFail/ErrCnt	045Ch	UINT16	
DC Low/ErrCnt	0460h	UINT16	
DC High/ErrCnt	0464h	UINT16	
GND Fail/GndErr	0468h	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Short C/ErrCnt	05ACh	UINT16	(Available from FW4.32)
ImagnLow/ImagLow	046Ch	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
ImagnLow/ErrCnt	0470h	UINT16	
Cur Low/Cur Low	0474h	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Cur Low/ErrCnt	0478h	UINT16	
Cur High/CurHigh	047Ch	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Cur High/Delay	0480h	UINT16	s/10^1
Cur High/ErrCnt	0484h	UINT16	
Run Fail/RunFail	0488h	ENUM	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Run Fail/ErrCnt	048Ch	UINT16	

Table 4: User interface parameters

6.2.6 Fieldbus Control Parameters

Table 5 shows parameters used for fieldbus control. The table gives Name, address and type of the parameters. The usage and coding of these parameters is not fieldbus specific and is described in detail in chapter 7.

Name	Register	Type	Scaling/Coding
SW Ver	02B0h	UINT16	1/10^2
NFOVer	02B4h	UINT16	1
Inv St (With Ack)	02A4h	ENUM	See Chapter 8.2

Name	Register	Type	Scaling/Coding
Inv St (Without Ack)	02A5h	ENUM	
DrvCtrl Write Mask	0250h (AND)	2 * UINT16	See Chapter 7.1
	0251h (OR)		
DriveControl	0254h	UINT16	
DriveStatus	0258h, 0259h	UINT32	
MODE	0294h	ENUM	See Chapter 7.2
SCMD	0298h	ENUM	
ProfidriveControl	0218h	UINT16	See Chapter 7.3
ProfidriveStatus	0210h	UINT16	
FrqScl Numerator	**TBD**	SINT32	FrqScl = Numerator/Denominator Default 1/10[1], see ch 8.3.1.
FrqScl Denominator	**TBD**	SINT32	
SpdScl Numerator	0268h, 0269h	SINT32	SpdScl = Numerator/Denominator Default 1, see ch 8.3.2
SpdScl Denominator	026Ah, 026Bh	SINT32	
TrqScl Numerator	**TBD**	SINT32	TrqScl = Numerator/Denominator Default T-nom/ 10[2] see ch 8.3.3.
TrqScl Denominator	**TBD**	SINT32	
RegScl Numerator	**TBD**	SINT32	RegScl = Numerator/Denominator Default 1/10[1], see ch 8.3.4.
RegScl Denominator	**TBD**	SINT32	
FrqSet	03FCh	SINT16	Hz/FrqScl, see ch 8.3.1
SpdSet	025Ch	SINT16	rpm/SpdScl, see ch 8.3.2
TrqSet	0408h	SINT16	Nm/TrqScl, see ch 8.3.3
RegSet	0410h	SINT16	Unit/RegScl, see ch 8.3.4

Table 5: Fieldbus Control Parameters

6.3 PROFIBUS DP-V1

6.3.1 General

PROFIBUS communication is accomplished by use of a fieldbus modules from HMS Industrial Networks AB.

The inverter control follows "Profile Drive Technology PROFIdrive Technical Specification for PROFIBUS and PROFINET V4.1" and is therefore not in detail described in this document.

The PROFIBUS connector (DB9F) is located at the bottom of the inverter housing for IP20 cases and inside the lower front panel for IP54 cases.

Next to the connector are two status LEDs marked OP (Operation Mode) and ST (Status).

State	Indication
Off	Not online / No power
Green	On-line, data exchange
Flashing Green	On-line, clear
Flashing Red (1 flash)	Parametrization error
Flashing Red (2 flash)	PROFIBUS configuration error

Table 6: Operation Mode LED

State	Indication
Off	Not initialised / No power
Green	Initialised
Flashing Green	Initialised, diagnostic event(s) present
Red	Exception error

Table 7: Status LED

6.3.2 Communication settings, parameter group 'Serial'

Parameter 'Address' sets the PROFIBUS slave address to which the inverter will respond. Valid range is 0 to 126. Default is 126, with this value the 'Set Slave Address'-servic is enabled. This gives the master or configuration tool the ability to set the node address from the network.

Note that changes of Address will not take effect until next power on, unless parameter Auto Reset is ON.

Parameter 'SiBaud' and 'SiProt' is not used.

6.3.3 Default settings for process data

6.3.4 Access of parameters through Acyclic Data Exchange

Acyclic data exchange is described in detail in “Profile Drive Technology PROFIdrive Technical Specification for PROFIBUS and PROFINET V4.1”.

6.3.5 PROFIdrive Parameters

Table 8 shows PROFIdrive parameters supported by NFO Sinus.

The information in this chapter is in general copied from the HMS documentation and/or “Profile Drive Technology PROFIdrive Technical Specification for PROFIBUS and PROFINET V4.1”

It is described here mostly to point out exactly which parameters are supported.

Definition	Prm	R/W	Data type	Value/Description	
Selection switch Setpoint telegram	P915	R	Array[n] UINT16	Holds the current configuration of the Setpoint telegram. See detailed description below table.	
Selection switch Actual value telegram	P916	R	Array[n] UINT16	Holds the current configuration of the Actual value telegram. See detailed description below table.	
Node Address	P918	R	UINT16	Current node address.	
Telegram Selection	P922	R	UINT16	Default value 1: Standard telegram 1. Reflects the latest accepted configuration data from the master.	
List of all parameters for signals	P923	R	Array[59999] UINT16	All parameters that are possible to mapito process data (i.e. is defined as PROFIdrive signals) are listed here. Subindex = Signal number. If a parameter connected to the specific signal is possible to map, the PNU number is returned. If not, 0 is returned. See detailed description below table.	
Status word bit Pulses Enabled	P924	R	Array[2] UINT16	Subindex 0: 2 (Signal number for ZSW1) Subindex 1: 15 (Bit position)	
Operating mode	P930	R/W	UINT16	0001h: Speed control mode 8000h: Torque control mode 8001h: Vendor-specific mode	
Fault message counter	P944	R	UINT16	Incremented by one for each time the fault buffer changes.	
Fault numbers	P947	R	Array[8] UINT16	Subindex 0 holds the active fault situation. Subindex 1-7 holds the fault history, where subindex 1 holds the most resent fixed fault situation.	
Scaling of fault buffer	P950	R	Array[2] UINT16	Subindex 0: 8 Subindex 1: 1 Defines the number of fault situations (8), and the number if fault messages (1) for each situation that the fault buffer can hold.	
Fault number list	P951	R	Array[255] UINT16	Holds descriptive text for each fault that is supported.	
Warning words	P953-P954	R	V2	Bit arrays for and descriptive text for the warnings in the module (minor diagnostics events).	
Device Identification	P964	R	Array[5] UINT16	Manufacturer ID	
				Drive Unit Type	0
				Version (software)	xxyy (decimal)
				Firmware data year	yyyy (decimal)
				Firmware data day/month	ddmm (decimal)
Profile number	P965	R	UINT16	Byte 0: 41 (Version 4.1) Byte 1: 3 (PRIFIdrive profile)	

Definition	Prm	R/W	Data type	Value/Description
Control word 1	P967		V2	
Status word 1	P968		V2	
Drive reset	P972	R/W	UINT16	1: Power-on reset 2: Prepare power-on reset See detailed description below table.
List of parameters	P980	R	Array[n] UINT16	Parameter numbers of all excisting parameters are saved in the subindicies (profile parameters and vendor specific). The array is assigned in increaseing sequence and consecutively. If a subindex contains zero, the end of the list has been reached.

Table 8: PROFIdrive Parameters

6.3.5.1 Parameter Details: P915/P916 Setpoint- and Actual Value

P915 and P916 are read only and consist of UINT16 arrays where number of elements corresponds to number of words in IO DATA. Each word in the telegram configuration holds the PNU of the parameter mapped to that particular IO DATA word.

The parameters reflect the latest accepted Parametrization data.

6.3.5.2 Parameter Details: P923 Signal List

TBD

6.3.5.3 Parameter Details: P944/P947Fault Handling

TBD

6.3.5.4 Parameter Details: P953/P954 Warning Words

TBD

6.3.5.5 Parameter Details: P972 Drive Reset

TBD

6.3.6 Vendor specific, User interface Parameters (Acyclic Data Exchange)

Table 9 shows parameters available from the keypad/display of NFO Sinus. The table is organized in groups, in the same way and order as they appears on the display. For a more detailed description of each parameter (for example usage, range and read/right capabilities), See the NFO Sinus Operation and Installation manual.

The parameters are described as they appear when accessed through the vendor specific area (PNU 1001 – 59999).

Some of the parameters are also reachable through standardised PROFIdrive parameters. Data types, coding and access rights may differ depending on PNU used for the access of these.

Parameters covered by PROFIdrive is preferably accessed through the PROFIdrive PNU, they are included here only to make the list complete.

There are some parameters that are stated writeable even as they have a valid range of only one value. This is for compatibility reasons.

Name	Prm	R/W	Data type	Scaling/Coding
Parameter group Motor				
P-Nom	P1006	R/W	UINT32	W
U-Nom	P1006	R/W	UINT16	V
f-Nom	P1007	R/W	UINT16	Hz
N-nom	P1008	R/W	UINT16	rpm
I-nom	P1009	R/W	UINT32	mA
cos-φ	P1010	R/W	UINT16	$1/10^3$
Tuning				
R-stat	P1011	R/W	UINT32	mΩ
R-rot	P1012	R/W	UINT32	mΩ
L-main	P1013	R/W	UINT32	µH
Sigma	P1014	R/W	UINT16	$1/10^3$
I-magn	P1015	R/W	UINT32	mA
I-limt	P1016	R/W	UINT32	mA
Parameter group Control				
Mode	P1036	R/W	UINT16	0 = Freque 1 = PI-Reg 2 = Torque 3 = Speed Also acceablle through PROFIdrive P930
Accel	P1028	R/W	Array[2] SINT32	Subindex 0: Delta speed Subindex 1: Delta time [ms]
Retard	P1029	R/W	Array[2] SINT32	Subindex 0: Delta speed Subindex 1: Delta time [ms]
RunDly	P1044	R/W	UINT16	s
DC-Brk	P1045	R/W	UINT16	s
AinSet	P1046	R/W	UINT16	3 = 0-20mA 4 = 4-20mA 5 = +/-20mA 6 = 0-10V 7 = 2-10V 8 = +/-10V 9 = Pot 10k
AutoStart	P1047	R/W	UINT16	0 = OFF 1 = ON

Name	Prm	R/W	Data type	Scaling/Coding
EnergySave	P1048	R/W	UINT16	0 = OFF 1 = ON
StMode	P1033	R/W	SINT16	0 = Release 1 = Brake
Kp-spd	P1049	R/W	UINT16	$1/10^2$
Ti-spd	P1050	R/W	UINT16	$s/10^2$
FSleep	P1051	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
Byp-fr	P1052	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
Byp-bw	P1053	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
Parameter group Freque				
OpMode	P1054	R/W	UINT16	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R
F-fix1	P1055	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix2	P1056	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix3	P1057	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix4	P1058	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix5	P1059	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix6	P1060	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
F-fix7	P1061	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
Fr-min	P1062	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
Fr-max	P1063	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
Parameter group Speed				

Name	Prm	R/W	Data type	Scaling/Coding
OpMode	P1064	R/W	UINT16	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6 R 003Dh = Fix-7 R
C-fix1	P1065	R/W	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix2	P1066	R/W	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix3	P1067	R/W	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix4	P1068	R/W	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix5	P1069	R/W	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix6	P1070	R/W	UINT16	rpm/SpdScl, see ch 8.3.2
C-fix7	P1071	R/W	UINT16	rpm/SpdScl, see ch 8.3.2
Sp-min	P1072	R/W	SINT16	rpm/SpdScl, see ch 8.3.2
Sp-max	P1073	R/W	SINT16	rpm/SpdScl, see ch 8.3.2
Parameter group Torque				
OpMode	P1074	R/W	UINT16	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R
T-fix1	P1075	R/W	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix2	P1076	R/W	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix3	P1077	R/W	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix4	P1078	R/W	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix5	P1079	R/W	UINT16	Nm/TrqScl, see ch 8.3.3
T-fix6	P1080	R/W	UINT16	Nm/TrqScl, see ch 8.3.3

Name	Prm	R/W	Data type	Scaling/Coding
T-fix7	P1081	R/W	UINT16	Nm/TrqScl, see ch 8.3.3
Tq-min	P1082	R/W	UINT16	Nm/TrqScl, see ch 8.3.3
Tq-max	P1083	R/W	UINT16	Nm/TrqScl, see ch 8.3.3
Max-fr	P1084	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
Parameter group PI-reg				
OpMode	P1085	R/W	UINT16	0081h = Terminal 0003h = Analog F 0005h = Analog R 000Bh = Fix-1 F 0013h = Fix-2 F 001Bh = Fix-3 F 0023h = Fix-4 F 002Bh = Fix-5 F 0033h = Fix-6 F 003Bh = Fix-7 F 000Dh = Fix-1 R 0015h = Fix-2 R 001Dh = Fix-3 R 0025h = Fix-4R 002Dh = Fix-5 R 0035h = Fix-6R 003Dh = Fix-7 R 0102h = Temp F 0103h = Temp R
R-fix1	P1086	R/W	SINT16	Unit/10^{1*}
R-fix2	P1087	R/W	SINT16	Unit/10^{1*}
R-fix3	P1088	R/W	SINT16	Unit/10^{1*}
R-fix4	P1089	R/W	SINT16	Unit/10^{1*}
R-fix5	P1090	R/W	SINT16	Unit/10^{1*}
R-fix6	P1091	R/W	SINT16	Unit/10^{1*}
R-fix7	P1092	R/W	SINT16	Unit/10^{1*}
Setmin	P1093	R/W	SINT16	Unit/10^{1*}
Setmax	P1094	R/W	SINT16	Unit/10^{1*}
Actmin	P1095	R/W	SINT16	Unit/10^{1*}
Actmax	P1096	R/W	SINT16	Unit/10^{1*}
T-min	P1097	R/W	SINT16	°C
T-max	P1098	R/W	SINT16	°C
RegAmp	P1099	R/W	SINT16	-1 or 1
RegKp	P1100	R/W	UINT16	$1/10^{2}$
RegTi	P1101	R/W	UINT16	$s/10^{1}$
Min-fr	P1102	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
Max-fr	P1103	R/W	UINT16	Hz/FrqScl, see ch 8.3.1

Name	Prm	R/W	Data type	Scaling/Coding
Unit	P1104	R/W	UINT16	0 = None 1 = Pa 2 = kPa 3 = bar 4 = rpm 5 = m^3/s 6 = l/s 7 = m^3/h 8 = l/h 9 = ppm 10 = % 11 = V 12 = Hz
AinAct	P1105	R/W	UINT16	0 = 0-10V 1 = 2-10V 2 = +/-10V
Parameter group Output				
ReMode	P1106	R/W	UINT16	0 = Disable 1 = Freque 2 = Run Fwd 3 = Run Rev 4 = Run Setp 5 = Run Freq
ReFreq	P1107	R/W	UINT16	Hz/FrqScl, see ch 8.3.1
V-Out	P1108	R/W	UINT16	0 = Disable 1 = Freque 2 = Speed 3 = Torque
V-Max	P1109	R/W	UINT16	$V/10^2$
F-Out	P1110	R/W	UINT16	0 = Disable 1 = Freque 2 = Speed 3 = Torque
F-Max	P1111	R/W	UINT16	Hz
Parameter group Serial				
BusType	P1112	R/W	UINT16	0 = None 1 = NFO 2 = MbusAsc 3 = MbusRtu 4 = ABCC
Adress	P1113	R/W	UINT16	
SiBaud	P1114	R/W	UINT16	16 = 1200bps 32 = 2400bps 64 = 4800bps 128 = 9600bps 256 = 19200bps 512 = 38400 bps 768 = 57600 bps

Name	Prm	R/W	Data type	Scaling/Coding
SiProt	P1115	R/W	UINT16	0 = 7b Ep 1s 1 = 7b Op 1s 2 = 7b Np 2s 4 = 8b Ep 1s 5 = 8b Op 1 6 = 8b Np 2s
SioTot	P1116	R/W	UINT16	s/10^1
AutoReset	P1117	R/W	UINT16	0 = OFF 1 = ON
AutoStop	P1118	R/W	UINT16	0 = OFF 1 = ON
Parameter group Status				
U-rms	P1119	R	SINT16	V
I-rms	P1120	R	SINT16	mA (A/10^3)
P-out	P1121	R	SINT16	W (kW/10^3)
PF	P1122	R	SINT16	1/10^3
DCLink	P1123	R	SINT16	V
FrqSet	P1124, IODATA2 (default if Mode = Freque)	R/W	SINT16	Hz/FrqScl, see ch 8.3.1
FrqAct	P1125, IODATA2 (default if Mode = Freque)	R	SINT16	Hz/FrqScl, see ch 8.3.1
SpdSet	P1020, IODATA2 (default if Mode = Speed)	R/W	SINT16	rpm/SpdScl, see ch 8.3.2
SpdAct	P1022, IODATA2 (default if Mode = Speed)	R	SINT16	rpm/SpdScl, see ch 8.3.2
TrqSet	P1127, IODATA2 (default if Mode = Torque)	R/W	SINT16	Nm/TrqScl, see ch 8.3.3
TrqAct	P1128, IODATA2 (default if Mode = Torque)	R	SINT16	Nm/TrqScl, see ch 8.3.3
RegSet	P1129	R/W	SINT16	Unit/10^{1*}
RegAct	P1130	R	SINT16	Unit/10^{1*}
PT1000	P1131	R	SINT16	°C/10^1
M-Temp	P1132	R	SINT16	%/10^1 (1/10^3)
OpTime	P1039	R	SINT32	h/10^1
RnTime	P1040	R	SINT32	h/10^1
BrTime	P1133	R	SINT32	s
E-Out	P1233	R	SINT32	kWh/10^3 (Available from FW4.38)
∑E-Out	P1234	R	SINT32	MWh/10^3 (Available from FW4.38)
Parameter group Error				

Name	Prm	R/W	Data type	Scaling/Coding
E-logg 1	P13157			
Elogg 2	P13158		32 * UINT32	
….		R		See Chapter ...
Elogg 31	P13187			
Elogg 32	P13188			
RstDly	P1134	R/W	UINT16	s
TrTime	P1135	R/W	UINT16	s
AC Fail/AC Err	P1136	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
AC Fail/Delay	P1137	R/W	UINT16	s/10[1]
AC Fail/ErrCnt	P1138	R/W	UINT16	
AC Fail/IT-Gnd	P1139	R/W	UINT16	0 = OFF 1 = ON
Temp Hi/ErrCnt	P1140	R/W	UINT16	
PTC Temp/PTCTmp	P1141	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
PTC Temp/ErrCnt	P1142	R/W	UINT16	
OverLoad/OverLd	P1143	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
OverLoad/ErrCnt	P1144	R/W	UINT16	
OverLoad/F-Cool	P1145	R/W	UINT16	
OverLoad/S-Temp	P1146	R/W	UINT16	°C
Ain Fail/AinErr	P1147	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
AinFail/ErrCnt	P1148	R/W	UINT16	
DC Low/ErrCnt	P1149	R/W	UINT16	
DC High/ErrCnt	P1150	R/W	UINT16	
GND Fail/GndErr	P1151	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Short C/ErrCnt	P1232	R/W	UINT16	(Available from FW4.32)
ImagnLow/ImagLow	P1152	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
ImagnLow/ErrCnt	P1153	R/W	UINT16	

Name	Prm	R/W	Data type	Scaling/Coding
Cur Low/Cur Low	P1154	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Cur Low/ErrCnt	P1155	R/W	UINT16	
Cur High/CurHigh	P1156	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Cur High/Delay	P1157	R/W	UINT16	s/10[1]
Cur High/ErrCnt	P1158	R/W	UINT16	
Run Fail/RunFail	P1159	R/W	UINT16	0 = Disable 64 = Ind 128 = Alarm 192 = Error
Run Fail/ErrCnt	P1160	R/W	UINT16	

Table 9: Vendor specific, User interface Parameters

6.3.7 Vendor specific, Control Parameters (Acyclic Data Exchange)

Table 10 shows vendor specific parameters used for fieldbus control. The table gives Name, address and type of the parameters. The usage and coding of these parameters is not fieldbus specific and is therefore described in detail in chapter 7

Name	PNU	R/W	Data type	Scaling/Coding
SW Ver	P1041	R	UINT16	1/10[2]
NFOVer	P1042	R	UINT16	1
Inv St	P1038	R	Array[2] SINT16	Subindex 0: With Ack Subindex 1: Without Ack See Chapter 8.2
DrvCtrl Write Mask	P1017	W	Array[2] UINT16	Subindex 0: AND-mask Subindex 1: OR-mask See Chapter 7.1
DriveControl	P1018	R/W	UINT16	See Chapter 7.1
DriveStatus	P1019	R	UINT32	
MODE	P1034	R/W	UINT16	See Chapter 7.2
SCMD	P1035	W	UINT16	
ProfidriveControl	P1003	R/W	UINT16	See Chapter 7.3
ProfidriveStatus	P1001	R	UINT16	
FrqScl	TBD	R/W	Array[2] UINT32	Subindex 0: Numerator Subindex 1: Denominator See Chapter 8.3.1
SpdScl	P1023	R/W	Array[2] UINT32	Subindex 0: Numerator Subindex 1: Denominator See Chapter 8.3.2

Name	PNU	R/W	Data type	Scaling/Coding
TrqScl	TBD	R/W	Array[2] UINT32	Subindex 0: Numerator Subindex 1: Denominator See Chapter 8.3.3
RegScl	TBD	R/W	Array[2] UINT32	Subindex 0: Numerator Subindex 1: Denominator See Chapter 8.3.4
FrqSet	P1124	R/W	SINT16	Hz/FrqScl, see ch 8.3.1
SpdSet	P1020	R/W	SINT16	rpm/SpdScl, see ch 8.3.2
TrqSet	P1127	R/W	SINT16	Nm/TrqScl, see ch 8.3.3
RegSet	P1129	R/W	SINT16	Unit/RegScl, see ch 8.3.4

Table 10: Vendor specific, Control Parameters

6.4 CANopen

The fieldbus connector is located at the bottom of the inverter housing for IP20 cases and inside the lower front panel for IP54 cases.

Next to the connector are two status LEDs marked RUN and ERR.

As soon as communication is established on the CANopen line, the fieldbus module will hold the inverter in bus-mode. Pressing <STOP> will stop a running motor temporary but bus-mode will be re-entered mediately. making it possible to start the motor by a new start command from the bus.

6.4.1 DS301 Communication Profile Objects

TBD

6.4.2 DS402 Communication Profile Objects

Table 11 shows DS402 objects supported by NFO Sinus.

There are some parameters that are stated writeable even as they have a valid range of only one value. This is for compatibility reasons.

DS 402 Object Name	Index	Sub-Index
Error_Code	603Fh	00h
		FFh
ControlWord	6040h	00h
		FFh
StatusWord	6041h	00h
		FFh
vl target velocity	6042h	00h
		FFh
vl velocity demand	6043h	00h
		FFh
vl velocity actual value	6044h	00h

DS 402 Object Name	Index	Sub-Index
		FFh
vl velocity min max amount	6046h	00h
		02h
		FFh
vl velocity acceleration	6048h	00h
		02h
		FFh
vl velocity deceleration	6049h	00h
		02h
		FFh
vl dimention factor	604Ch	00h
		02h
		FFh
Shutdown option code	605Bh	00h
		FFh
Disable operation code	605Ch	00h
		FFh
Modes of Operation	6060h	00h
		FFh
Modes of operation display	6061h	00h
		FFh
Target torque	6071h	00h
		FFh
Motor rated current	6075h	00h
		FFh
Motor rated torque **(Not yet implemented)**	6076h	00h
		FFh
Torque actual value	6077h	00h
		FFh
Torque slope **(Not yet implemented)**	6087h	00h
		FFh
Motor type	6402h	00h
		FFh
Supported drive modes	6502h	00h
		FFh

Table 11: DS402 Communication Profile Objects

6.4.3 User interface Parameters

Table 12 shows parameters available from the keypad/display of NFO Sinus. The table is organized in groups, in the same way and order as they appears on the display. For a more detailed description of each parameter (for example usage, range and read/right capabilities), See the NFO Sinus Operation and Installation manual.

The parameters are described as they appear when accessed through the manufacturer specific area (index range 2001h – 5FFFh).

Some of the parameters are also reachable through standardised DS402 (Drive Profile) objects. Data types, coding and access rights may differ depending on index used for the access.

Parameters covered by the Drive Profile is preferably accessed through the DS402 index, they are included here only to make the list complete.

Enum-parameters, not covered by the Drive Profile is separately described after the table.

There are some parameters that are stated writeable even as they have a valid range of only one value. This is for compatibility reasons.

Display Name (Object Name)	**Index**
Parameter group Motor	
P-Nom (RatedPower)	2005h
U-Nom (RatedVoltage)	2006h
f-Nom (RatedFrequency)	2007h
N-Nom (RatedSpeed)	2008h
I-Nom (RatedCurrent)	2009h
cosφ (RatedPowerFactor)	200Ah
Tuning	See parameter SCMD, chapter 6.4.4& 7.2.
R-stat (StatorResistance)	200Bh
R-rot (RotorResistance)	200Ch
L-main (MainInductance)	200Dh
Sigma (LeakageFactor)	200Eh
I-magn (MagnCurrentSetpt)	200Fh
I-limt (CurrentLimit)	2010h
Parameter group Control	
Mode (ControlMode)	2024h
Accel (Acceleration)	201Ch
Retard (Deceleration)	201Dh
RunDly (PowerOnStartDelay)	202Ch
DC-Brk (BrakeBeforeStartTime)	202Dh
AinSet (AnalogSetpointType)	202Eh
AutoStart (AutoStartMode)	202Fh
EnergySave (EnergySaveMode)	2030h
StMode (ShutdownOptionCode)	2021h
Kp-spd (SpeedCtrlAmp)	2031h
Ti-spd (SpeedCtrlIntegrTime)	2032h
Fsleep (SleepFrequency)	2033h
Byp-fr	2034h

Display Name (Object Name)	Index
(BypassFrequency)	
Byp-bw (BypassBandwidth)	2035h
Parameter group Freque	
OpMode (FreqSetpointSource)	2036h
F-fix1 (FixedFrequency1)	2037h
F-fix2 (FixedFrequency2)	2038h
F-fix3 (FixedFrequency3)	2039h
F-fix4 (FixedFrequency4)	203Ah
F-fix5 (FixedFrequency5)	203Bh
F-fix6 (FixedFrequency6)	203Ch
F-fix7 (FixedFrequency7)	203Dh
Fr-Min (MinimumAinFreque)	203Eh
Fr-Max (MaximumAinFreque)	203Fh
Parameter group Speed	
OpMode (SpeedSetpointSource)	2040h
C-fix1 (FixedSpeed1)	2041h
C-fix2 (FixedSpeed2)	2042h
C-fix3 (FixedSpeed3)	2043h
C-fix4 (FixedSpeed4)	2044h
C-fix5 (FixedSpeed5)	2045h
C-fix6 (FixedSpeed6)	2046h
C-fix7 (FixedSpeed7)	2047h
Sp-Min (MinimumAinSpeed)	2048h
Sp-Max (MaximumAinSpeed)	2049h
Parameter group Torque	
OpMode (TorqueSetpointSource)	204Ah
T-fix1 (FixedTorque1)	204Bh
T-fix2 (FixedTorque2)	204Ch
T-fix3 (FixedTorque3)	204Dh
T-fix4 (FixedTorque4)	204Eh
T-fix5	204Fh

Display Name (Object Name)	Index
(FixedTorque5)	
T-fix6 (FixedTorque6)	2050h
T-fix7 (FixedTorque7)	2051h
Tq-Min (MinimumAinTorque)	2052h
Tq-Max (MaximumAinTorque)	2053h
Max-fr (TorqueMaxFrequency)	2054h
Parameter group PI-reg	
OpMode (RegSetpointSource)	2055h
R-fix1 (RegFixedSetpoint1)	2056h
R-fix2 (RegFixedSetpoint2)	2057h
R-fix3 (RegFixedSetpoint3)	2058h
R-fix4 (RegFixedSetpoint4)	2059h
R-fix5 (RegFixedSetpoint5)	205Ah
R-fix6 (RegFixedSetpoint6)	205Bh
R-fix7 (RegFixedSetpoint7)	205Ch
Setmin (RegSetpointMinValue)	205Dh
Setmax (RegSetpointMaxValue)	205Eh
Actmin (RegActualMinValue)	205Fh
Actmax (RegActualMaxValue)	2060h
T-min (RegulatorMinTemp)	2061h
T-max (RegulatorMaxTemp)	2062h
RegAmp (RegulatorAmp)	2063h
RegKp (RegulatorKp)	2064h
RegTi (RegulatorTi)	2065h
Min-fr (RegulatorMinFrequency)	2066h
Max-fr (RegulatorMaxFrequency)	2067h
Unit (RegulatotUnit)	2068h
AinAct (RegActInputMode)	2069h
Parameter group Output	
ReMode (RelayIndMode)	206Ah

Display Name (Object Name)	Index
ReFreq (RelayIndFrequency)	206Bh
V-Out (VoltageOutputMode)	206Ch
V-Max (MaxOutputVoltage)	206Dh
F-Out (PulseOutputMode)	206Eh
F-Max (MaxOutputFrequency)	206Fh
Parameter group Serial	
BusType (FieldbusType)	2070h
Address (FieldbusIdentity)	2071h
SiBaud (FieldbusBaudrate)	2072h
SiProt (FieldbusCharCoding)	2073h
SiTout (FieldbusTimeout)	2074h
Auto Reset (FieldbusAutoReset)	2075h
Auto Stop (FieldbusAutoStop)	2076h
Parameter group Status	
U-rms (OutputVoltage)	2077h
I-rms (OutputCurrent)	2078h
P-out (OutputPower)	2079h
PF (OutputPowerFactor)	207Ah
Dclink	207Bh
FrqSet (SetpointFrequency)	207Ch
FrqAct (ElectricalFrequency)	207Dh
SpdSet (SetpointSpeed)	2014h
SpdAct (ActualSpeed)	2016h
TrqSet (TargetTorque)	207Fh
TrqAct (ActualTorque)	2080h
RegSet (SetpointRegulator)	2081h
RegAct (RegulatorActual)	2082h
PT1000 (PT1000Temperature)	2083h
M-Temp (RelativeMotorTemp)	2084h
OpTime	2027h

Display Name (Object Name)	Index
(OperatingTime)	
RnTime (RunningTime)	2028h
BrTime (BrakeTime)	2085h
E-Out (kiloWatthourCounter)	20E9h (Available from FW4.38)
∑E-Out (MegaWatthourCounter)	20EAh (Available from FW4.38)
Parameter group Error	
E-logg 1	2F7Ch
E-logg 2	2F7Dh
…..	
E-logg 31	2F9Ah
E-logg 32	2F9Bh
RstDly (ErrorRestartDelay)	2086h
TrTime (ErrorTrialTime)	2087h
AC Fail / AC Err (ModeMainsAlarm)	2088h
AC Fail / Delay (DelayMainsalarm)	2089h
AC Fail / ErrCnt (TriesMainsAlarm)	208Ah
AC Fail / IT-Gnd (IT-Gnd)	208Bh
Temp Hi / ErrCnt (TriesHiTempAlarm)	208Ch
PTC Temp / PTCTmp (ModeTermistorAlarm)	208Dh
PTC Temp / ErrCnt (TriesTermistorAlarm)	208Eh
Overload / OverId (ModeOverloadAlarm)	208Fh
Overload / ErrCnt (TriesOverloadAlarm)	2090h
Overload / F-Cool (ForcedCooling)	2091h
Overload / S-Temp (SurroundTemperature)	2092h
Ain Fail / AinErr (ModeAnalogInAlarm)	2093h
Ain Fail / ErrCnt (TriesAnalogInAlarm)	2094h
DC Low / ErrCnt (TriesDClinkLow)	2095h
DC High / ErrCnt (TriesDClinkHigh)	2096h
GND Fail / GndErr (ModeGroundFault)	2097h
Short C/ErrCnt (TriesShortCircuit)	20E8h (Available from FW4.32)
ImagnLow / ImagLow (ModeImagnAlarm)	2098h
ImagnLow / ErrCnt (TriesImagnAlarm)	2099h

Display Name (Object Name)	Index
Cur Low / Cur Low (ModeCurrentLowAlarm)	209Ah
Cur Low / ErrCnt TriesCurrentLowAlarm	209Bh
Cur High / CurHigh (ModeCurrentHighAlarm)	209Ch
Cur High / Delay (DelayCurrentHighAlarm)	209Dh
Cur High / ErrCnt (TriesCurrentHighAlarm)	209Eh
Run Fail / RunFail (ModeRunFailAlarm)	209Fh
Run Fail / ErrCnt (TriesRunFailAlarm)	20A0h

Table 12: User Interface Parameters

6.4.4 Fieldbus Control Parameters

Table 13 shows parameters used for fieldbus control. The table gives Name, address and type of the parameters. The usage and coding of these parameters is not fieldbus specific and is described in detail in chapter 7.

Name (Object Name)	Index (DS301)
SW Ver (CopFirmwareVersion)	2029h
NFOVer (DspFirmwareVersion)	202Ah
Inv St (InverterStatus)	2026h
DriveControlMaskWrite	2011h
DriveControl	2012h
DriveStatus	2013h
MODE (ControlSource)	2022h
SCMD (ControlCommand)	2023h
ProfidriveControl	2003h
ProfidriveStatus	2001h
FrqScl (FrequeScale)	TBD
SpdScl (SpeedScale)	2017h
TrqScl (TorqueScale)	TBD
RegScl (RegulatorScale)	TBD

Table 13: Fieldbus Control Parameters

Name (Object Name)	Index (DS301)	Sub-Index
SetpointSource	2025h	00h
		FFh

7 Fieldbus control

Fieldbus control is done through a generic state machine, implemented in the inverter.

Inverters equipped with a fieldbus module, normally also supports a drive profile, specific for that particular bus. In this case the generic state machine is controlled by the module, thus invisible for the user, who only has to deal with the drive profile of the selected fieldbus. How to control through these bus-specific drive profiles is not described in this document.

In case the fieldbus module does not include any driveprofile support or if one of the built in protocols (Modbus or the classic NFO protocol) is used, there are alternative ways of control.

1. Direct access of the generic state machine, chapter 7.1.
2. Control through parameters MODE & SCMD, chapter 7.2 Earlier the only way of controlling through the serial interface. Commands are translated to control words, passed to the generic state machine.
3. Control through PROFIdrive Control/Status words, chapter 7.3 Earlier the only way of controlling through fieldbus. The Control/Status words are adjusted before/after they are passed to/from the generic state machine.

Note. It is recommended to choose one of the control methods and not combining them, at least not in the same run-session. The behaviour of doing that is not specified and can vary between firmware versions.

Note. Regardless of if the inverter is equipped with a drive profile fieldbus module or not, autotuning is at present only possible through parameter SCMD.

7.1 Direct access of the generic state machine.

Commands is given in a control word, accessed either directly (parameter 'DriveControl'), or through a AND/OR-mask (parameter 'DrvCtrlWriteMask'). 'DriveControl' is read/writable while 'DrvCtrlWriteMask' is write only. Writing to 'DrvCtrlWriteMask' reads the value of 'DriveControl', and first makes a bitwise AND with the AND-mask then takes the result and makes a bitwise OR with the OR-mask, finaly the result is written to 'DriveControl'.

'DriveStatus' is a read only parameter describing the current status of the state machine.

The meaning of each bit of DriveControl and DriveStatus is explained in Table 14 & 15.

The generic state machine is described in Table 16 & Figure 1.

Bit #	Name	Description
0	SwitchOn	Value: 0 — Stop Value: 1 — Start. If bit 12 is not set, a positive edge is required for transition SWITCH_ON_DISABLED → READY_TO_SWITCH_ON.
1	EnableVoltage	Value: 0 — Disable power. Since it is not safe to disable power at any time, resetting this bit at runtime will have the same effect as bit 2 Value: 1 — Enable power
2	DisableQuickStop	Value: 0 — Enable quick stop. If reset at runtime, QUICK_STOP is entered. When power is disabled, continue to SWITCH_ON DISABLED. Value: 1 — Disable quick stop.
3	EnableOp	Value: 0 — Bit 13 = 0: Disable operation. Bit 13 = 1: Enable reverse operation Value: 1 — Bit 13 = 0: Enable operation Bit 13 = 1: No change of operation
4	EnableRfg	Value: 0 — Reset ramp generator (RGF) output to zero Value: 1 — Use RFG output as ramp output value
5	UnlockRfg	Value: 0 — Lock RFG output to current output value Value: 1 — Unlock RFG output (follow ramp input value)
6	UseRefForRfg	Value: 0 — Set RFG input to zero Value: 1 — Use reference speed as RFG input
7	ResetMalfunction	Value: 0→1 — Reset fault condition
8-9	(reserved)	(reserved for future use; mask off/zero as necessary)
10	EventTriggedOp	Value: 0 Value: 1 — Event required on EnableOp/EnableRevOp for transition SWITCHED_ON → OPERATION_ENABLED
11	OverrideCoast	Value: 0 Value: 1 — Override stop function with coast. The drive performs a coast stop from DISABLE, SHUTDOWN or QUICK_STOP
12	AutoInit	Value: 0 Value: 1 — Transition SWITCH_ON_DISABLE→READY_TO_SWITCH_ON regardless of bit 0.
13	EnableRevOp	See bit 3
14	NetCtrl	Value: 0 — Request local drive control Value: 1 — Request drive control from network.
15	NetRef	Value: 0 — Request local reference Value: 1 — Request reference from network

Table 14: Coding of DriveControl

Bit #	Name	Description
0	ReadyToSwitchOn	Value Meaning 0 For some reason not ready to enable outputs. Either drive is being initialized, faulted, ControlWord bit 1 or 2 is zero or waiting ControlWord bit 0 to be reset. 1 Output ready to be (or already) enabled.
1	SwitchedOn	Value Meaning 0 Output not enabled 1 Output enabled, or waiting for direction (ControlWord bit 3/13).
2	OpEnabled	Value Meaning (see also bit 14) 0 Bit 14 = 0: Drive function disabled. Bit 14 = 1: Drive function enabled in reverse mode. 1 Bit 14 = 0: Drive function enabled in forward mode. Bit 14 = 1. This combination is not used.
3	Faulted	Value Meaning 0 1 Fault present or waiting foe acknowledged of fault.
4	VoltageEnabled	Value Meaning 0 Power disabled 1 Power enabled
5	QuickstopDisabled	Value Meaning 0 Executing quick stop request. 1 Quick stop disabled.
6	SwitchOnDisabled	Value Meaning 0 1 Drive in SWITCH_ON_DISABLED
7	(reserved)	(reserved for future use; set to zero)
8	RefFromNet	Value Meaning 0 Local rference 1 Network reference
9	CtrlFromNet	Value Meaning 0 Local control 1 Network control
10	SetpointReached	Value Meaning 0 1 Actual output equals reference
11	LimitActive	Value Meaning 0 1 Limitation is active.
12-13	(reserved)	(reserved for future use; set to zero)
14	RevOpEnabled	See bit 2
15	Stopping	Value Meaning 0 1 Drive is stopping

Table 15: Coding of DriveStatus

State [StatusWord]	Description
NOT_READY_TO_SWITCH_ON [00XX XXXX X0XX 0000]	Initial state, drive is being initialized or is running selftest. Drive function disabled. When ready, if no fault has occurred, automatically proceed to SWITCH_ON_DISABLED.
SWITCH_ON_DISABLED [00XX XXXX X1XX 0000]	Drive initialization is complete, no fault has occurred. Drive function disabled. When DriveControl bit 1 & 2 is set and bit 0 is reset or bit 12 is set, proceed to READY_TO_SWITCH_ON
READY_TO_SWITCH_ON [00XX XXXX X01X 0001]	Drive function disabled, no fault has occurred. If any of DriveControl bit 1 or 2 is reset, return to SWITCH_ON_DISABLED. When DriveControl bit 0 is set, proceed SWITCHED_ON.
SWITCHED_ON [00XX XXXX X01X 0011]	Drive function disabled, power may be applied to the motor. no fault has occurred. If any of DriveControl bit 0, 1 or 2 is reset and voltage is turned off, return to READY_TO_SWITCH_ON. Waiting for valid direction (DriveControl bit 3 & 13 either 01 or 10). If DriveControl bit 10 is set direction has to change in this state in order to bee seen as valid. When fulfilled proceed to OPERATION_ENABLED.
OPERATION_ENABLED [00XX XXXX X01X 0111] or [01XX XXXX X01X 0011]	Normal operation, drive function is enabled, power is applied to the motor, no fault has occurred. If DriveControl bit 1 or 2 is reset, go to QUICK_STOP. If DriveControl bit 0 is reset, go to SHUTDOWN. If direction is lost (both DriveControl bit 3 & 13 is reset), go to DISABLE.
DISABLE [10XX XXXX X01X 0111] or [11XX XXXX X01X 0011]	Drive function is enabled, power is applied to the motor no fault has occurred. Brakes towards zero rpm according to ramp. If DriveControl bit 1 or 2 is reset, go to QUICK_STOP. If DriveControl bit 0 is reset go to SHUTDOWN. If valid direction is received, return to OPERATION_ENABLED. When zero rpm is reached or if DriveControl 11 is set, go to SWITCHED_ON.
SHUTDOWN [10XX XXXX X01X 0111] or [11XX XXXX X01X 0011]	Drive function is enabled, power is applied to the motor no fault has occurred. Stops according to ShutdownOptionCode (brake or coast). Or, if DriveControl 11 is set, coast is chosen. When motor voltage is turned off, go back to READY_TO_SWITCH_ON. If any of DriveControl bit 1 or 2 is reset, go to QUICK_STOP. If DriveControl bit 0 is set return to OPERATION_ENABLED.
QUICK_STOP [10XX XXXX X00X 0111] or [11XX XXXX X00X 0011]	Drive function is disabled, power may still be applied to the motor, no fault has occurred. Performs a coast stop. When motor voltage is turned off, go back to SWITCH_ON_DISABLED.
FAULT_REACTION_ACTIVE [10XX XXXX X0XX 1111] or [11XX XXXX X0XX 1011]	Entered from any state (except FAULTED) when drive detects a fault condition. Drive function is disabled, power may still be applied to the motor. Performs a coast stop. When voltage is turned off, proceed to FAULTED.
FAULTED [00XX XXXX X0XX 1000]	Drive has detected a fault condition. Drive function disabled. Waiting for, first the fault condition to disappear and then acknowledged by a positive transition on DriveControl bit 7. When done, proceeds to SWITCH_ON_DISABLED.

Table 16: Generic state machine description

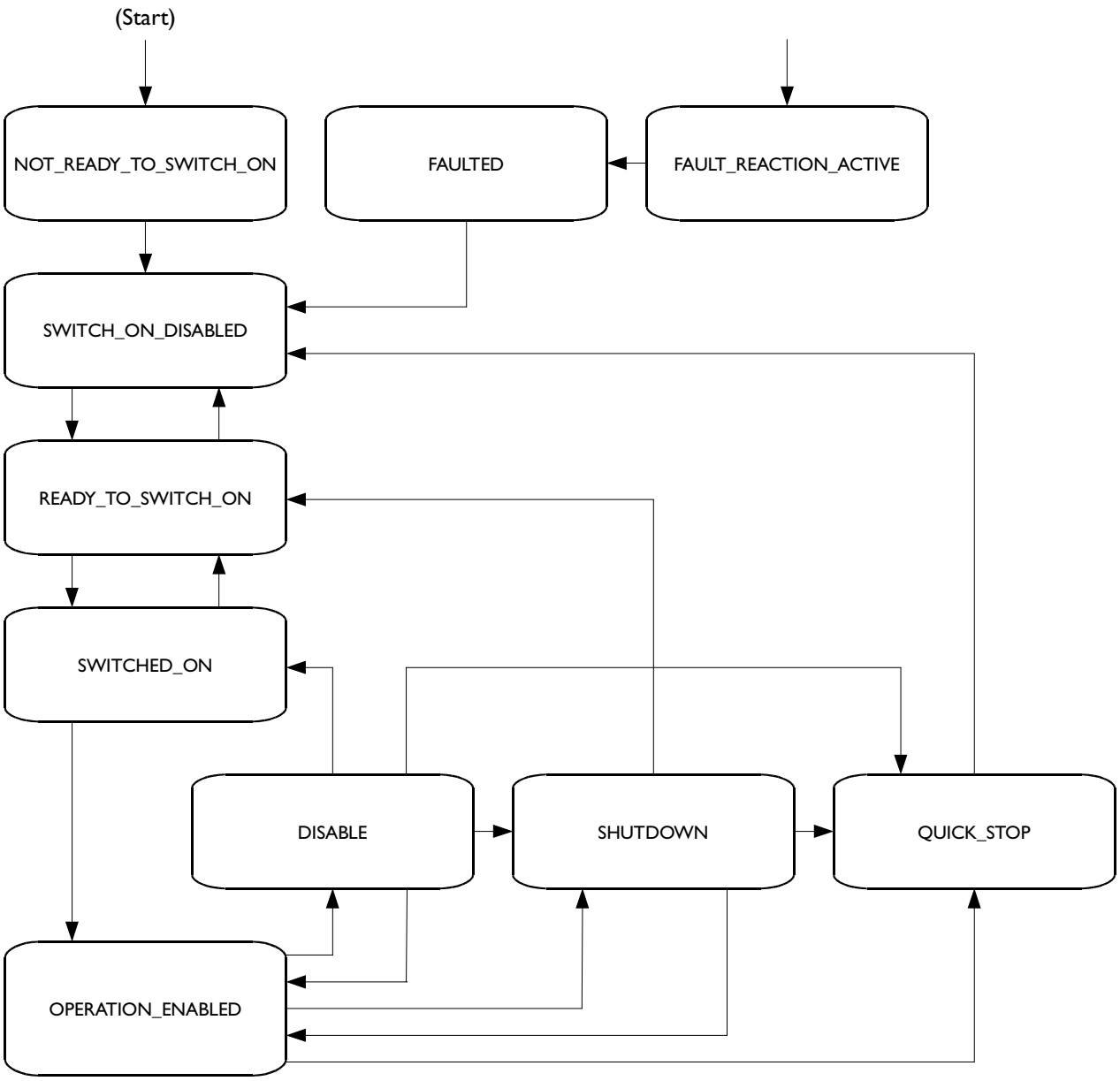


Figure 1 Generic state machine graphics

7.2 Control through parameters MODE/SCMD

This is the classic way of controlling the NFO Sinus inverter through the serial interface. Start/Stop commands are given by the serial command parameter, SCMD. SCMD is “write only” (reading is not allowed) and the control source (parameter MODE) has to be set to 'Bus' prior to any command.

Note that if the classic NFO serial protocol is used, Bus-mode has to be entered prior to any write instructions (except for parameter MODE). For other buses this requirement only counts for the SCMD parameter.

The coding of parameters MODE and SCMD is explained in the table 17 & 18 below.

Code	MODE	Explanation.
0	Inhibit	Inverter not available for fieldbus control., for example tuning in progress, Writing to MODE is not accepted. This value can not be written from the bus.
1	Stop	Inverter status "Stop". Motor not running. If this value is written while running, motor will be released, same as if <Stop> is pressed on the keypad.
2	Ext	Returned when in Ext mode (running or not) or running from keypad. Writing this value will put the inverter in Ext mode. Note that if inverter is in Stop mode and 'RUN' is active, writing this value will start the motor, just as if <Shift+Stop> is pressed on keypad.
3	Bus	Returned when in fieldbus control mode. Writing this value will stop a running motor and put the inverter in 'Bus Stby', waiting for control from fieldbus.

Table 17: Coding of Parameter MODE

Code	SCMD	Explanation.
0x00	Stop	Stops a running motor, status goes to 'Bus Stby'
0x03	Analog F	Run in forward direction, reference from analogue input.
0x05	Analog R	Run in reverse direction, reference from analogue input.
0x0B	Fix-1 F	Run in forward direction, fixed reference 1.
0x0D	Fix-1 R	Run in reverse direction, fixed reference 1.
0x13	Fix-2 F	Run in forward direction, fixed reference 2.
0x15	Fix-2 R	Run in reverse direction, fixed reference 2.
0x1B	Fix-3 F	Run in forward direction, fixed reference 3.
0x1D	Fix-3 R	Run in reverse direction, fixed reference 3.
0x23	Fix-4 F	Run in forward direction, fixed reference 4.
0x25	Fix-4 R	Run in reverse direction, fixed reference 4.
0x2B	Fix-5 F	Run in forward direction, fixed reference 5.
0x2D	Fix-5 R	Run in reverse direction, fixed reference 5.
0x33	Fix-6 F	Run in forward direction, fixed reference 6.
0x35	Fix-6 R	Run in reverse direction, fixed reference 6.
0x3B	Fix-7 F	Run in forward direction, fixed reference 7.
0x3D	Fix-7 R	Run in reverse direction, fixed reference 7.
0x41	OpMode	Run with reference source given by parameter OpMode.
0x81	Terminal	Run with reference source given by digital I/O combination.
0x101	Fieldbus	Run with reference from fieldbus. See chapter 8.3
0x201	Full Tuning	Full tuning, returns to 'SioStby' when ready
0x301	Basic Tuning	Basic tuning, returns to 'SioStby' when ready
0x401	Rs Measure	Stator resistance measurement, returns to 'SioStby' when ready
0x501	Par Calc	Start parameter calculation, returns to 'SioStby' when ready
0x800	Erase E-log	Erase Error Logg.
0x900	Reset E-Out	Reset kWh-counter (Available from FW4.38)

Table 18: Coding of Parameter SCMD

7.3 Running motor through PROFIdrive

This is the classic way of controlling the NFO Sinus inverter through fieldbus interface. Older versions (before FW 4.28) used PROFIdrive Control/Status word independent of fieldbus type. These together with setpoint and actual speed were the only parameters available through the fieldbus interface.

For backward compatibility reasons, PROFIdrive Control and Status words are available as parameters independent of the fieldbus used.

When writing to the PROFIdrive Control word, the value is translated (see fig 2) and passed to the generic state machine, described in chapter 7.1.

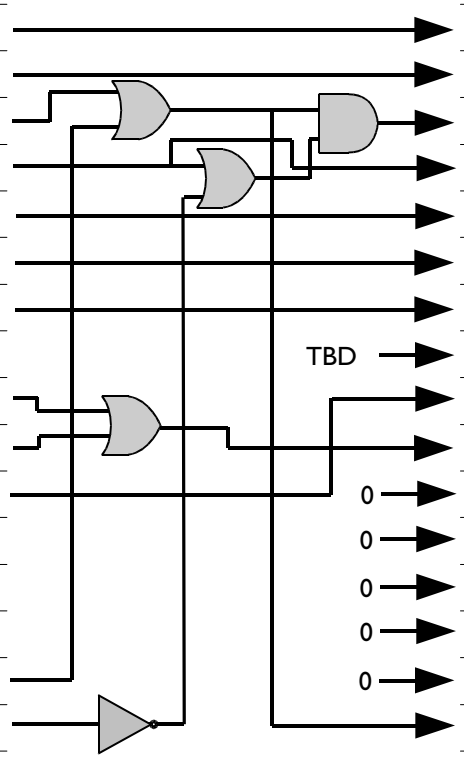
When reading the PROFIdrive Status word, the returned value is the generic statemachine DriveStatus, (see chapter 7.1) translated as described in fig 3.

PROFIdrive Control word	
Bit	**Contents**
0	ON
1	No Coast Stop
2	No Quick Stop
3	Enable Operation
4	Enable Ramp Generator
5	Unfreeze Ramp Gen.
6	Enable Setpoint
7	Fault Acknowledge
8	Jog 1 ON
9	Jog 2 ON
10	Control by PLC
11	
12	
13	
14	
15	

	DriveControl (Table 14)	
	Contents	**Bit**
	SwitchOn	0
	EnableVoltage	1
	DisableQuickStop	2
	EnableOp	3
	EnableRfg	4
	UnlockRfg	5
	UseRefForRfg	6
	ResetMalfunction	7
		8
		9
0	EventTriggedOp	10
	OverrideCoast	11
0	AutoInit	12
0	EnableReverseOp	13
	NetCtrl	14
	NetRef	15

Figure 2: Translation of PROFIdrive Control word to generic DriveControl

DriveStatus (Table 15)	
Bit	**Contents**
0	ReadyToSwitchOn
1	SwitchedOn
2	OpEnabled
3	Faulted
4	VoltageEnabled
5	QuickStopDisabled
6	SwitchOnDisable
7	
8	RefFromNet
9	CtrlFromNet
10	SetpointReached
11	LimitActive
12	
13	
14	ReverseOpEn
15	Stopping



PROFIdrive Status word	
Contents	**Bit**
Ready To Switch On	0
Ready To Operate	1
Operation Enabled	2
Fault Present	3
Coast Stop Not Activated	4
Quick Stop Not Activated	5
Switching On Inhibited	6
Warning Present	7
Speed Error Within Limits	8
Control Requested	9
f Or n Reached	10
	11
	12
	13
	14
Pulses Enabled	15

Figure 3: Translation of generic DriveStatus to PROFIdrive Status word

8

8.1 Firmware Versions 'SW Ver' & 'NFOVer'

Reading of these parameters returns the firmware version of the two processors in the inverter. 'SW Ver' gives the version of the user interface for example the value 428 for V4.28. 'NFOVer' gives the version of the motor controller, for example 4018.

8.2 Inverter Status, 'Inv St'

The inverter status is normally read as text on the display. From fieldbus, the status is represented by a code explained by Table 19. Some codes represent errors that have to be acknowledged before the motor is allowed to start. There are two different parameters reading the status, one that acknowledges a pending error and one that does not.

The same codes are also used in the error log, see chapter 8.4.

Code	Display Text	Requires ACK	Inverter status
0	Erased		This value is passed when an empty entry of the Error Log is read.
1	Par Fail	X	At power on, some parameter was outside permitted range or factory reset command was given.
2	AC Fail	X	Phase error, power supply phases not symmetrical.
3	Temp Hi	X	Inverter heat sink temperature too high.
4	PTC Temp	X	Motor overheating, thermistor input limit exceeded.
5	Overload	X	The power monitor has tripped. The motor connected has been working under overload for too long time.
6	Ain Fail	X	Analogue reference input signal out of range.
7	DC Low	X	DC link voltage too low.
8	DC High	X	DC link voltage too high
9	GND Fail	X	Earth leak current in one or more motor phases too high.
10	ImagnLow	X	Magnetising current in motor out of range.
11	Cur Low	X	Current in one or more motor phases too low.
12	Cur High	X	Current in one or more motor phases too high.
13	Run Fail	X	Inverter failed to get the motor axle spin.
14	Sio Fail	X	Classic NFO Serial protocol error. Acknowledged by reading parameter SioErr.
15	Bus Fail		Field bus fault, internal communication with fieldbus module faulted.
16	TunFailP	X	Autotuning failed, calculation overflow.
17	TunFailM	X	Autotuning failed, measurement fault.
18	NFO Fail	X	Internal fault.
19	CopReset	X	
20	NfoReset	X	
21	CommRest	X	
22	ParRange	X	
23	ExeTimeE	X	
24	Stop		Keypad control, motor switched off
25	Wait…		Start delay active.
26	Brake Ch		Brake chopper on.
27	Cur Limt		Current limit reached.
28	Tuning		Autotuning in progress.
29	St still		Keypad control, motor stationary, running with zero reference.
30	Final fr		Keypad control, reference reached.
31	Loc Acc		Keypad control, speed increases towards reference.
32	Loc Ret		Keypad control, speed decreases towards reference.
33	Ext Stby		External control, awaits active RUN signal on terminal.
34	Ext Run		External control, running, active RUN signal on terminal.
35	Ext Acc		External control, speed increases towards reference.

36	Ext Ret		External control, speed decreases towards reference.
37	Bus Stby		Fieldbus control, motor switched off.
38	Bus Run		Fieldbus control, running, active RUN signal on terminal.
39	Bus Acc		Fieldbus control, speed increases towards reference.
40	Bus Ret		Fieldbus control, speed decreases towards reference.
45	TuningOK		Full tuning successful
46	RsMeasOK		Rs measurement successful
47	ParClcOK		Parameter calculation successful

Table 19: Coding of Parameter InvSt

8.3 Scaling of reference parameters

When running motor with SCMD=Fieldbus or through DriveCtrl with NetRef=1, the reference is past in one of four parameters depending on control mode (Freque, Speed, Torque or PI Reg). Control mode is set by parameter Mode in group Control. Each reference parameter is scaled according to the control mode, explained the following four sections.

8.3.1 Scaling of frequency parameters

All Frequency parameters, except F-nom in group Motor and F-max in group Output, is scaled by FrqScl. FrqScl consists of two 32bit values, numerator and denominator. FrqScl is calculated as numerator divided by denominator.

When writing to the inverter, the value arriving on the network is multiplied by FrqScl to get the frequency in Hz.

When reading from the inverter, the frequency in Hz is divided by FrqScl before passed on the network.

Factory default for FrqScl is 1/10.

8.3.2 Scaling of speed parameters

All speed parameters, except N-nom in group Motor, is scaled by SpdScl. SpdScl consists of two 32bit values, numerator and denominator. SpdScl is calculated as numerator divided by denominator.

When writing to the inverter, the value arriving on the network is multiplied by SpdScl to get the speed in rpm.

When reading from the inverter, the speed in rpm is divided by SpdScl before passed on the network.

Factory default for SpdScl is 1/1.

8.3.3 Scaling of torque parameters

All torque parameters is scaled by TrqScl. TrqScl consists of two 32bit values, numerator and denominator. TrqScl is calculated as numerator divided by denominator.

When writing to the inverter, the value arriving on the network is multiplied by TrqScl to get the torque in Nm.

When reading from the inverter, the torque in Nm is divided by TrqScl before passed on the network.

Factory default for TrqScl is T-nom /100 (% of Nominal torque of connected motor).

8.3.4 Scaling of PI Reg in/out parameters

TBD

8.4 Reading the Error Log

The Error Log consists of 32 entries, each read as a 32bit value representing one event. The content of the log is presented in order of arrival with the most resent event in the first entry, the second most resent in the second entry, and so on. The 32bit value combines a time-stamp in the least significant 24 bits and an error-code in the 8 most significant bits. The time-stamp is a copy of the OPTime parameter in group Status at the time the event occurred. The error-code is coded the same way as parameter InvSt, see chapter 8.2. Reading error-code 0 (Erased) indicates 'End of Log', all entries beyond will return the same value. The log is erased through parameter SCMD, see chapter 7.2.