USER'S MANUAL

NX FREQUENCY CONVERTERS

ADFIF101

DC-DC

Application Manual

Vacon DC-DC application

INDEX

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1. INTRODUCTION

As a default the control place (P3.1) of the AFE drive is Keypad.

This application requires NXP3 control board VB761D version.

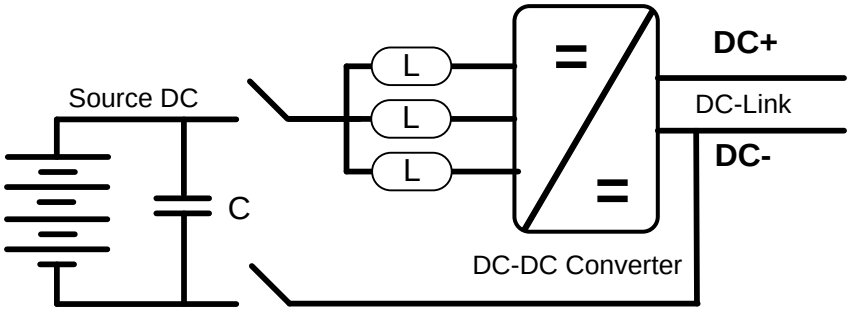


Figure 1, DC-DC connection

2. DC-DC APPLICATION COMPATIBILITY ISSUES

V015

- No Compatibility issues.

Note 1: When updating application it's not recommended to use NCDrive parameter download function. Instead upload parameters from the unit and make comparation to old parameter file. Application is constantly developed, this includes changing parameter default values, if parameters are directly downloaded to drive, improved default values will be lost.

3. OPERATION

3.1 Main

3.2 Quick Start instructions

NOTE! Before taking any commissioning actions read carefully the safety instructions in Vacon NX User's Manual, chapter 1.

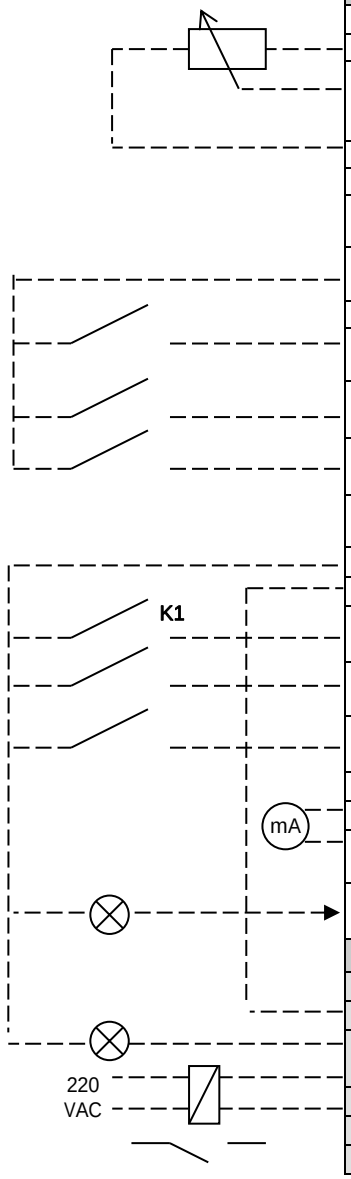
[Visio: DC-DC Start Sequence]

Figure 0-2. DC-DC start sequence

[Visio: DC-DC Fault Sequence]

Figure 0-3. Fault handling in DC-DC application

4. CONTROL IO



NXOPTA1			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference voltage output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1. Range 0-10V, R_i = 200Ω Range 0-20 mA R_i = 250Ω	Analogue input 1 Input range selected by jumpers. Default range: Voltage 0 – 10 V
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2. Range 0-10V, R_i = 200Ω Range 0-20 mA R_i = 250Ω	Analogue input 2 Input range selected by jumpers. Default range: Current 0 – 20 mA
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start Request Programmable G2.3.1	Contact closed = Start Request
9	DIN2	Programmable G2.3.1	No function defined at default
10	DIN3	Fault Reset Programmable G2.3.1	Rising edge will reset active faults.
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Programmable G2.3.1	No function defined at default
15	DIN5	Programmable G2.3.1	No function defined at default
16	DIN6	Programmable G2.3.1	No function defined at default
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AOA1+	Analogue output 1 Programmable P2.3.1.2	Output range selected by jumpers. Range 0—20 mA. R_L, max. 500Ω Range 0—10 V. R_L > 1kΩ
19	AOA1-		
20	DOA1	Digital output Ready / Warning (Blinking)	Programmable Open collector, I≤50mA, U≤48 VDC
NXOPTA2			
21	RO1	**RELAY OUTPUT 1** Programmable G2.4.1	Switching capacity 24 VCD / 8 A 250 VAC / 8 A 125 VDC / 0.4 A
22	RO1		
23	RO1		
24	RO2	Relay output 2	
25	RO2		
26	RO2		

Table 5-2. Default I/O configuration.

K1

5. DC-DC APPLICATION – MONITORING VALUES

On the next pages you will find the lists of parameters within the respective parameter groups.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number
Parameter = Name of parameter
Min = Minimum value of parameter
Max = Maximum value of parameter
Unit = Unit of parameter value; Given if available
Default = Value preset by factory
Cust = Customer's own setting
ID = ID number of the parameter
= On parameter code: Parameter value can only be changed after the Drive has been stopped.
= Monitoring value is possible to control from fieldbus by ID number

The manual presents signals that are not normally visible for monitoring. i.e. is not a parameter or standard monitoring signal. These signals are presented with [Letter]. e.g. [FW]MotorRegulatorStatus

[V] Normal monitoring signal
[P] Normal parameter in application.
[FW] Firmware signal, Can be monitored with NCDrive when signal type is selected Firmware
[A] Application signal, can be monitored with NCDrive when signal type is selected Application.
[R] Reference type parameter on keypad.
[F] Function. Signal is received as a output of function.
[DI] Digital input signal.

5.1 Monitoring values

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

5.1.1 Monitoring 1

Code	Signal	Unit	ID	Description
V1.1	Source Current	A	1104	
V1.2	Active Current Reference	%	1704	
V1.3	Active Current	%	1125	Active current of the drive in % of Source Nominal Current > 0 power from DC-Link To Source < 0 Current from Source to DC-Link
V1.4	Source Voltage	V	1107	
V1.5	Source DC Ref.	%	606	
V1.6	Source DC Act.	%	1873	
V1.7	DC-Link Current	A	1861	
V1.8	DC-Link Voltage	V	1108	Measured DC Link voltage in Volts, filtered
V1.9	DC-Link Act.	%	7	
V1.10	Unit Temperature	°C	8	Heat sing temperature
V1.11	Status Word		43	

5.1.2 Monitoring 2 values

Code	Signal	Unit	ID	Description
V1.12.1	DC Voltage	V	44	Unfiltered
V1.12.2	Current	A	1113	Unfiltered
V1.12.3	IU Current	%	1851	
V1.12.4	IV Current	%	1852	
V1.12.5	IW Current	%	1868	
V1.12.6	Power kW	kW	1508	
V1.12.7	Neg Iq Limit	%	1855	
V1.12.8	Pos Iq Limit	%	1854	
V1.12.9	Mindex	%	1856	
V1.12.10	Power %	%	5	
V1.12.11	Voltage Meas.	%	1866	Connect external measurement to this monitoring value.

5.1.3 Fieldbus values

Code	Signal	Unit	ID	Description
V1.13.1	FB Control Word		1160	
V1.13.2	FB Status Word		68	
V1.13.3	Warning No.		74	
V1.13.4	Fault No.		37	

5.2 Monitoring Values description

5.2.1 Monitoring 1 values

V1.1 Source Current A ID1104

Sum current of all phases.

V1.2 Active Current Reference % ID1704

Active current reference of the drive in % of Source Nominal Current
> 0 Current from DC-Link To Source
< 0 Current from Source to DC-Link

V1.3 Active Current % ID1125

Active current of the drive in % of Source Nominal Current
> 0 Current from DC-Link To Source
< 0 Current from Source to DC-Link

V1.4 Source Voltage V 1107

Estimated source voltage.

V1.5 Source DC Ref. % 606

DC Reference for the DC Source Voltage in % of Source Nom Voltage.

V1.6 Source DC Act. % 1873

DC Actual of the DC Source in % of Source Nom Voltage.

V1.7 DC-Link Current A 1861

Calculated DC-Link Current in A.

V1.8 DC-Link Voltage V 1108

Measured DC-link voltage in Vdc

V1.9 DC-Link Act. % 7

Measured DC-Link voltage in % of Source Nom Voltage.

V1.10 Unit Temperature °C 8

Highest measured drive temperature.

V1.11 Status Word 43

Application Status Word combines different drive statuses to one data word.

	Application Status Word ID43	
	FALSE	TRUE
b0		
b1	Not in Ready state	Ready
b2	Not Running	Running
b3	No Fault	Fault
b4		
b5		
b6	Run Disabled	Run Enable
b7	No Warning	Warning
b8		Charging Switch closed (internal)
b9		Over Voltage Regulator Active
b10		Under Voltage regulator active.
b11		
b12	No Run Request	Run Request
b13		One or more regulators active
b14		
b15		

5.2.2 Monitoring 2 values

V1.12.1 DC Voltage V 44

Unfiltered DC-Link Voltage in V.

V1.12.2 Current A 1113

Unfiltered source DC current in A.

V1.12.3 IU Current % 1851

Unfiltered U phase current.

V1.12.4 IV Current % 1852

Unfiltered U phase current.

V1.12.5 IW Current % 1853

Unfiltered U phase current.

V1.12.6 Power kW kW 1508

Calcualted Kw value of source.

V1.12.7 Neg Iq Limit % 1855

Used Active Current limit on charging side.

V1.12.8 Pos Iq Limit % 1854

Used Active Current limit on discharging side.

V1.12.9 Mindex % 1856

Voltage reference as % of unit nominal voltage (500 V / 690 V)

V1.12.10 Power % % 5

Calculated power based on given nominal values.

V1.12.11 Voltage Meas. % 1866

Measured voltage. If Source DC voltage is available by external measuremend make ID connection to this monitoring value. Scaling: 100,00 (10000) = Source Nominal Voltage.

5.2.3 Fieldbus monitoring values

V1.13.1 FB Control Word ID 1160

Control word from fieldbus. Below table is for bypass operation for such fieldbus board that natively supports this or can be parameterized to bypass mode. See details from chapter 8 Fieldbus profile for Vacon DC-DC Drive.

	Main Control Word ID1160	
	Signal	Comment
B00	DC Charge	**0**= **1**= Charge DC
B01		
B02		
B03	Run	**0**= AFE is stopped **1**= AFE is started
B04		
B05		
B06		
B07	Reset	0>1 Reset fault.
B08		
B09		
B10	PLC Control	**0**= Disable FB Control **1**= Enable FB Control
B11	FB DIN1	Can be used to control RO or directly parameter by ID number. G2.4.1
B12	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B13	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B14	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B15		

V1.13.2 FB Status Word ID 68

Status word to fieldbus. Below table is for bypass operation for such fieldbus board that natively supports this or can be parameterized to bypass mode.

	Main Status Word ID68	
	Signal	Comment
B00	Ready On	0=Drive not ready to switch on 1=Drive ready to start charging
B01	Ready Run	0=Drive not ready to run 1=Drive ready and Main Contactor is ON
B02	Running	0=Drive not running 1=Drive in Run state (Modulating)
B03	Fault	0=No active fault 1=Fault is active
B04	Run Enable Status	0= Run Disabled. Drive in stop state 1= Run Enabled. Drive can be started.
B05		
B06		
B07	Warning	0= No active warnings 1= Warning active
B08		
B09	Fieldbus Control Active	0=Fieldbus control not active 1=Fieldbus control active
B10		
B11		
B12		
B13		
B14		
B15		

V1.13.3 Warning No. ID74

Number if last active warning.

V1.13.4 Fault No. ID37

Number if last active fault.

6. PARAMETER LIST

6.1 Basic parameters

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.1.1	Source Nom Current	0,0	Varies	A	Varies	113	Capacity of supply,
P2.1.2	Source Nom Voltage	200	1099	V	Varies	110	
P2.1.4	Control Mode	0	1		0	1858	0 = Current 1 = Voltage
P2.1.4	Identification	0	1		0	631	0 = No Action 1 = Current. Meas. Offset.

Table 5-2. Basic parameters

6.2 Reference Handling

6.2.1 Voltage

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.2.1.1	Voltage Reference	0	320	%	100	1462	
P2.2.1.2	Drooping	0	100	%	0	620	
P2.2.1.3	Voltage Reference Ramp Rate	-1	320	%/s	5	1867	
P2.2.1.4	Voltage Reference At Start	0	2		0	1864	0 = Reference 1 = Start Voltage Reference 2 = Measurement
P2.2.1.5	Start Voltage Reference	0	320	%	0	1865	

Table 1- 1, Voltage Reference Handling

6.2.2 Current

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.2.2.1	Current Reference	-150	150	%	0	1860	
P2.2.2.2.1	Phase Reference Mode	0	1		0	1859	0 = Common 1 = Individual
P2.2.2.2.2	IU Current Reference	-300	300	%	0	128	
P2.2.2.2.3	IV Current Reference	-300	300	%	0	129	
P2.2.2.2.4	IW Current Reference	-300	300	%	0	130	

Table 1- 2, Current Reference Handling

6.3 Input signals

6.3.1 Digital inputs

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.3.1.1	Start Signal 1	0.1	E.10	DigIn	A.1	403	
P2.3.1.2	Run Enable	0.1	E.10	DigIn	0.2	407	
P2.3.1.3	Fault Reset	0.1	E.10	DigIn	A.3	414	
P2.3.1.4	External fault	0.1	E.10	DigIn	0.1	405	
P2.3.1.5	DC CB State	0.1	E.10	DigIn		1453	

Table 5-3. Digital inputs parameters

6.3.2 Analogue Input 1

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.3.2.1	AI1 signal selection	0.1	E.10		0.1	377	
P2.3.2.2	AI1 filter time	0,000	32,000	s	0,000	324	
P2.3.2.3	AI1 custom minimum setting	-160,00	160,00	%	0,00	321	
P2.3.2.4	AI1 custom maximum setting	-160,00	160,00	%	100,00	322	
P2.3.2.5	AI1 signal inversion	0	1		0	387	
P2.3.2.6	AI1 reference scaling, minimum value	-32000	32000		0	303	
P2.3.2.7	AI1 reference scaling, maximum value	-32000	32000		0	304	
P2.3.2.8	AI1 Controlled ID	0	10000		0	1507	

Table 1- 3, ANALOG INPUT1,

6.3.3 Analogue Input 2

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.3.3.1	AI2 signal selection	0.1	E.10		0.1	388	
P2.3.3.2	AI2 filter time	0,000	32,000	s	0,000	329	
P2.3.3.3	AI2 custom minimum setting	-160,00	160,00	%	0,00	326	
P2.3.3.4	AI2 custom maximum setting	-160,00	160,00	%	100,00	327	
P2.3.3.5	AI2 signal inversion	0	1		0	398	
P2.3.3.6	AI2 reference scaling, minimum value	-32000	32000		0	393	
P2.3.3.7	AI2 reference scaling, maximum value	-32000	32000		0	394	
P2.3.3.8	AI2 Controlled ID	0	10000		0	1511	

Table 1- 4, ANALOG INPUT2,

6.3.4 Analogue Input 3

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.3.4.1	AI3 signal selection	0.1	E.10		0.1	141	
P2.3.4.2	AI3 filter time	0,000	32,000	s	0,000	142	
P2.3.4.3	AI3 custom minimum setting	-160,00	160,00	%	0,00	144	
P2.3.4.4	AI3 custom maximum setting	-160,00	160,00	%	100,00	145	
P2.3.4.5	AI3 signal inversion	0	1		0	151	
P2.3.4.6	AI3 reference scaling, minimum value	-32000	32000		0	1037	
P2.3.4.7	AI3 reference scaling, maximum value	-32000	32000		0	1038	
P2.3.4.8	AI3 Controlled ID	0	10000		0	1509	

Table 1- 5, ANALOG INPUT2,

6.3.5 Analogue Input 4

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.3.5.1	AI4 signal selection	0.1	E.10		0.1	152	
P2.3.5.2	AI4 filter time	0,000	32,000	s	0,000	153	
P2.3.5.3	AI4 custom minimum setting	-160,00	160,00	%	0,00	155	
P2.3.5.4	AI4 custom maximum setting	-160,00	160,00	%	100,00	156	
P2.3.5.5	AI4 signal inversion	0	1		0	162	
P2.3.5.6	AI4 reference scaling, minimum value	-32000	32000		0	1039	
P2.3.5.7	AI4 reference scaling, maximum value	-32000	32000		0	1040	
P2.3.5.8	AI4 Controlled ID	0	10000		0	1510	

Table 1- 6, ANALOG INPUT2,

6.4 Output signals

6.4.1 Digital Outputs

Code	Parameter	Min	Max	Unit	Default	ID	Description
2.4.1.1	Ready	0.1	E.10	DiOut		432	
2.4.1.2	Running	0.1	E.10	DiOut		433	
2.4.1.3	Fault	0.1	E.10	DiOut		434	
2.4.1.4	Fault, Inverted	0.1	E.10	DiOut		435	
2.4.1.5	Warning	0.1	E.10	DiOut		436	
2.4.1.6	FB DIN 1 Par ID	0.1	E.10	DiOut		891	
2.4.1.7	FB DIN 2 Par ID	0.1	E.10	DiOut		892	
2.4.1.8	FB DIN 3 Par ID	0.1	E.10	DiOut		893	
2.4.1.9	FB DIN 4 Par ID	0.1	E.10	DiOut		894	
2.4.1.10	Charge DC	0.1	E.10	DiOut		1668	

Table 5-4. Digital outputs parameters

6.4.2 Analogue Output 1

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.4.2.1	Iout 1 Signal	0.1	E.10	AnOUT		464	
P2.4.2.2	Iout 1 Content	0				307	
P2.4.2.3	Iout 1 Filter Time	0	10	s		308	
P2.4.2.4	Iout 1 Invert	0	1			309	
P2.4.2.5	Iout 1 Minimum	0	1			310	
P2.4.2.6	Iout 1 Scale	10	1000	%		311	
P2.4.2.7	Iout 1 Offset	-100	100	%		375	

Table 5-5. Analogue Output 1 parameters

6.5 Limit Settings

6.5.1 Current Limit

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.5.1.1	Current Limit	0	Varies	A	Varies	107	Total current limit
P2.5.1.2	Charging Limit	0	300	%	105	1290	
P2.5.1.2	Discharge Limit	0	300	%	105	1289	

6.5.2 Under Voltage Control

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.5.2.1	Under Voltage Reference	0	320	%	65	1567	
P2.5.2.2	Under Voltage Droop	0	100	%	0	1863	
P2.5.2.3	Under Voltage Kp	0	32000		50	1468	
P2.5.2.4	Under Voltage Ti	0	32000		15	1409	
P2.5.2.5	Under Voltage Kp Add	0	32000		50	1425	

6.5.3 Over Voltage Control

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.5.2.1	Over Voltage Reference	0	320	%	118	1528	
P2.5.2.2	Over Voltage Droop	0	100	%	0	1862	
P2.5.2.3	Over Voltage Kp	0	32000		50	699	
P2.5.2.4	Over Voltage Ti	0	32000		15	698	
P2.5.2.5	Over Voltage Kp Add	0	32000		50	697	

6.5.4 Source Voltage

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.5.4.1	Source Min Voltage	50,0	1100,0	Vdc		1893	
P2.5.4.2	Source Max Voltage	50,0	1100,0	Vdc		1895	
P2.5.4.3	Source Voltage Hysteresis	0,0	100,0	Vdc	5,0	1896	

6.6 Drive Control parameters

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.6.1	Switching frequency	3,6	Varies	kHz	5,0	601	Switching frequency
P2.6.2	Chopper Options	0	65535		0	1463	
P2.6.3	Over Modulation Limit	0	250		100	1515	
P2.6.4	Advanced Options 1	0	65535		0	1560	
P2.6.5	Advanced Options 2	0	65535		0	1561	
P2.6.6	Advanced Options 3	0	65535		0	1562	
P2.6.7	Advanced Options 4	0	65535		0	1563	
P2.6.8	Advanced Options 5	0	65535		0	1564	
P2.6.9	Advanced Options 6	0	65535		0	1565	
P2.6.10	Inverse Synch	0	1		0	1857	
P2.6.11	Control Options 1	0	65535		0	1707	
Identification G2.6.12							
2.6.12.1	IU Offset	-32000	32000		10000	668	
2.6.12.2	IV Offset	-32000	32000		0	669	
2.6.12.3	IW Offset	-32000	32000		0	670	
2.6.12.4	Source Resistance	0	10000		1	662	

Table 5-6. Drive control parameters

6.7 DC Control Parameters

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.7.1	Current Control Kp	1,00	320,00	%	20,00	617	
P2.7.2	Current Control Ti	0,1	3200,0	ms	1,5	657	
P2.7.3	Voltage Control Kp	1	32000		200	1870	
P2.7.4	Voltage Control Ti	1	32000		50	1871	

Table 5-6. Drive control parameters

6.8 Fieldbus parameters

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.8.1	FB Actual Selection	0	65535		1125	1853	Choose monitoring data with parameter ID
P2.8.2	GSW ID	0	65535		0	897	
P2.8.3	Fieldbus data out 1 selection	0	65535		0	852	
P2.8.4	Fieldbus data out 2 selection	0	65535		0	853	
P2.8.5	Fieldbus data out 3 selection	0	65535		0	854	
P2.8.6	Fieldbus data out 4 selection	0	65535		0	855	
P2.8.7	Fieldbus data out 5 selection	0	65535		0	856	
P2.8.8	Fieldbus data out 6 selection	0	65535		0	857	
P2.8.9	Fieldbus data out 7 selection	0	65535		0	858	
P2.8.10	Fieldbus data out 8 selection	0	65535		0	859	
P2.8.11	FB Reference Selector	0	65535		0	1850	Choose controlled data with parameter ID
P2.8.12	Fieldbus data in 1 selection	0	65535		0	876	
P2.8.13	Fieldbus data in 2 selection	0	65535		0	877	
P2.8.14	Fieldbus data in 3 selection	0	65535		0	878	
P2.8.15	Fieldbus data in 4 selection	0	65535		0	879	
P2.8.16	Fieldbus data in 5 selection	0	65535		0	880	
P2.8.17	Fieldbus data in 6 selection	0	65535		0	881	
P2.8.18	Fieldbus data in 7 selection	0	65535		0	882	
P2.8.19	Fieldbus data in 8 selection	0	65535		0	883	
P2.8.20	State Machine	0	1		0	896	

Table 5-8. Fieldbus parameters G2.6

6.9 Protections (Control keypad:

6.9.1 General

Code	Parameter	Min	Max	Unit	Default	ID	Description
2.9.1	FB Communication Response	0	2		2	733	

Table 5-9. Protections parameters

6.10 Keypad control (Control keypad: Menu M3)

Code	Parameter	Default	Min	Max	Unit	ID	Description
P3.1	Control place	2	0	2		1403	0=Fieldbus 1=I/O terminal 2=Keypad (Default)
P3.2	License Key	0	0	65535		1995	

Table 5-11. Keypad control parameters M3

6.11 System menu (Control keypad: Menu M6)

For parameters and functions related to the general use of the frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see Chapter 7.3.6 in the Vacon NX User's Manual.

6.12 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 7.3.7 in the Vacon NX User's Manual and Vacon I/O option board manual.

7. DESCRIPTION OF PARAMETERS

7.1 Basic parameters

P2.1.1 Source Nom Current ID113

This parameter defines current value that is used as 100 % current for e.g. charging current limit.

P2.1.2 Source Nom Voltage ID110

This parameter defines absolute voltage value that is used as 100 % voltage for e.g. voltage reference.

P2.1.3 Control Mode ID1858

Selection if drive is current controlled or voltage controlled mode.

0 = Current
1 = Voltage

P2.1.4 Identification ID631

Identification function will calibrate current measurement.

0 = No Action
1 = Current measurement offset

When identification is done drive needs to be connected to battery system or the used DC power source. And there should not be any load on DC-link.

Select identification run and give DC-DC converter start command within 20 second after identification mode is selected.

7.2 Reference Handling

7.2.1 Voltage

P2.2.1.1 Voltage Reference ID1462

Voltage reference in per cent of Source Nom Voltage

P2.2.1.2 Drooping ID620

Voltage reference drooping. Used when parallel DC-DC converters are used.

P2.2.1.3 Voltage Reference Ramp Rate ID1867

Voltage reference ramp rate in %/s.

P2.2.1.4 Voltage Reference At Start ID1864

Mode how voltage reference starting value is handled on start.

0 = Reference
Starting voltage is directly given reference P2.2.1.1 Voltage Reference.

1 = V Ref Start
Starting voltage is defined by parameter P2.2.1.5 Start Voltage Reference and ramped to actual reference with set ramp rate.

2 = Measurement
Starting voltage is taken from measured voltage V1.9 Voltage Meas. ID1866. This monitoring value can be written by analogue ID function or from fieldbus.

P2.2.1.5 Start Voltage Reference ID1865

Voltage value that is used for initial start voltage when P2.2.1.4 Voltage Reference At Start is 1 / V Ref Start.

7.2.2 Current

P2.2.2.1 Current Reference ID1860

Per cent value of P2.1.1 System Rated Current.

P2.2.2.2.1 Phase Reference Mode ID1859

Select if same current reference is used for all phases or current is controlled individually.

0 = Common
P: Current Reference is used for all phases.
1 = Individual phase control
Each phase is controlled separately with G2.2.2.2 parameters

P2.2.2.2.2 IU Current Reference ID128

U phase current reference on individual mode.

P2.2.2.2.3 IV Current Reference ID129

U phase current reference on individual mode.

P2.2.2.2.4 IW Current Reference ID130

U phase current reference on individual mode.

7.3 Input Signals

7.3.1 Digital Inputs

P2.3.1.1 Start Signal 1 ID403
Signal selection 1 for the start/stop logic. This parameter is used to select the input for Run Request signal

P2.3.1.2 Run Enable ID407
When the signal is low, the drive will lose READY status.
Contact open: the start of drive disabled.
Contact closed: the start of drive enabled.

P2.3.1.3 Fault Reset ID414
Contact closed: all faults are reset. Rising edge.

P2.3.1.4 External fault ID405
Contact open: the fault is displayed and the motor stopped. Fault 51. Can be inverted by the input inversion control.

P2.3.1.5 DC CB State ID1453
Feedback from DC Circuit breaker status.

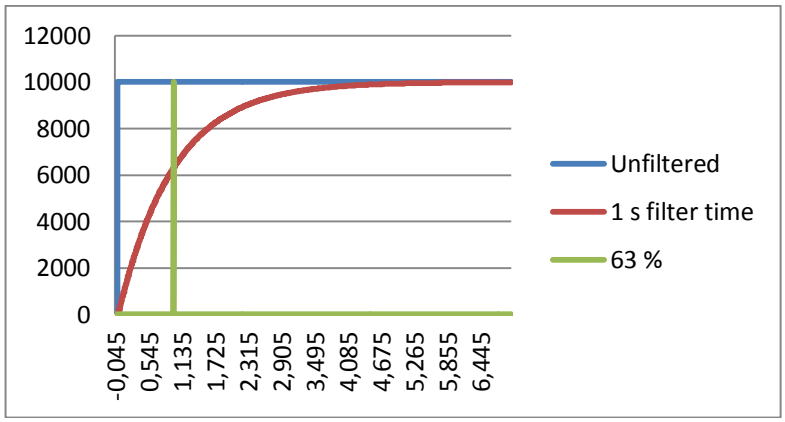
7.3.2 Analogue Inputs 1-4

2.3.2.1	*AI1 signal selection*	*ID377*	*"AI1 Signal Sel"*
2.3.3.1	*AI2 signal selection*	*ID388*	*"AI2 Signal Sel"*
2.3.4.1	*AI3 signal selection*	*ID141*	*"AI3 Signal Sel"*
2.3.5.1	*AI4 signal selection*	*ID152*	*"AI4 Signal Sel"*

Connect the AI3/AI4 signal to the analogue input of your choice with this parameter. When analogue input selection parameter is set to 0.1 you can control analogue input monitoring variable from Fieldbus by assign process data input ID number to monitoring signal thus allowing making of scaling function in drive side to PLC input signals.

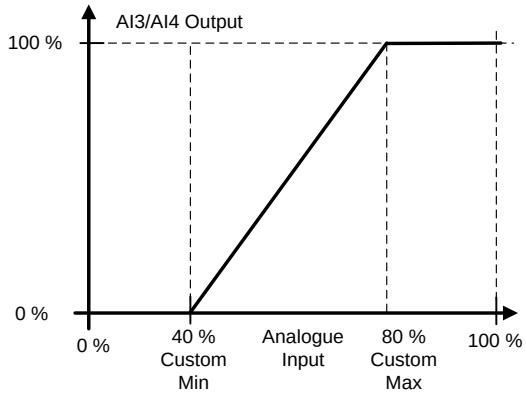
2.3.2.2	*Analogue input 1 signal filtering time*	*ID324*	*"AI1 Filter Time"*
2.3.3.2	*Analogue input 2 signal filtering time*	*ID329*	*"AI2 Filter Time"*
2.3.4.2	*Analogue input 3 signal filtering time*	*ID142*	*"AI3 Filter Time"*
2.3.5.2	*Analogue input 4 signal filtering time*	*ID153*	*"AI3 Filter Time"*

First order filtering is used for analogue inputs signals 3 and 4.



2.3.2.3	*AI1 custom setting minimum*	*ID321*	*"AI1 Custom Min"*
2.3.2.4	*AI1 custom setting maximum*	*ID322*	*"AI1 Custom Max"*
2.3.3.3	*AI2 custom setting minimum*	*ID326*	*"AI2 Custom Min"*
2.3.3.4	*AI2 custom setting maximum*	*ID327*	*"AI2 Custom Max"*
2.3.4.3	*AI3 custom setting minimum*	*ID144*	*"AI3 Custom Min"*
2.3.4.4	*AI3 custom setting maximum*	*ID145*	*"AI3 Custom Max"*
2.3.5.3	*AI4 custom setting minimum*	*ID155*	*"AI4 Custom Min"*
2.3.5.4	*AI4 custom setting maximum*	*ID156*	*"AI4 Custom Max"*

Set the custom minimum and maximum input levels for the AI3 signal within -160...160%.



2.3.2.5 AI1 signal inversion ID387 "AI1 Signal Inv"

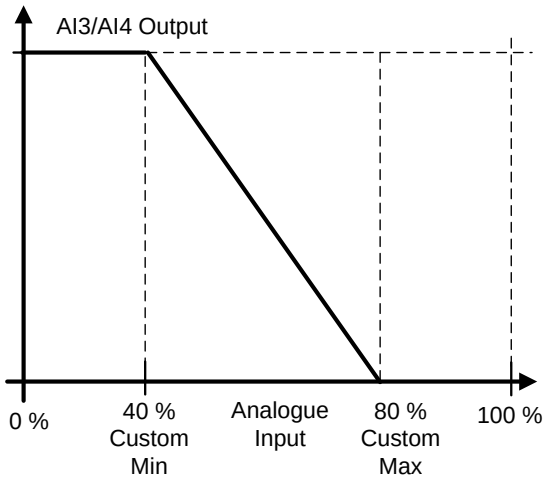
2.3.3.5 AI2 signal inversion ID398 "AI2 Signal Inv"

2.3.4.5 AI3 signal inversion ID151 "AI3 Signal Inv"

2.3.5.5 AI4 signal inversion ID162 "AI3 Signal Inv"

Signal inversion function is useful in situation when e.g. PLC is sending power limit to the drive by using analogue inputs, if PLC is unable to communicate to the drive power limit would be normally zero, by using inverted signal logic zero value from PLC would mean maximum power limit thus allowing drive running e.g. from keypad without changing power limit function parameters.

0 = No inversion
1 = Signal inverted



.7.3.2.1 Analogue input to any parameter

This function allows control of any parameter by using analogue input. with parameters it is selected what will be range of control area and ID number for paramter that is controller

2.3.2.6	*Analogue input 1, minimum value*	*ID303 "AI1 Scale Min"*
2.3.2.7	*Analogue input 1, maximum value*	*ID304 "AI1 Scale Max"*
2.3.3.6	*Analogue input 2, minimum value*	*ID393 "AI2 Scale Min"*
2.3.3.7	*Analogue input 2, maximum value*	*ID394 "AI2 Scale Max"*
2.3.4.6	*Analogue input 3, minimum value*	*ID1037 "AI3 Scale Min"*
2.3.4.7	*Analogue input 3, maximum value*	*ID1038 "AI3 Scale Max"*
2.3.5.6	*Analogue input 4, minimum value*	*ID1039 "AI4 Scale Min"*
2.3.5.7	*Analogue input 4, maximum value*	*ID1040 "AI4 Scale Max"*

These parameters are defining range for controlled parameter. All the values are considered to be integers thus when controlling FWP as in example you need to set also numbers for decimals. e.g. FWP 100,00 needs to be set as 10000.

2.3.2.8	*AI1 Controlled ID*	*ID1507*	*"AI1 Control. ID"*
2.3.3.8	*AI2 Controlled ID*	*ID1511*	*"AI2 Control. ID"*
2.3.4.8	*AI3 Controlled ID*	*ID1509*	*"AI3 Control. ID"*
2.3.5.8	*AI4 Controlled ID*	*ID1510*	*"AI4 Control. ID"*

These parameters define what controller parameter is.

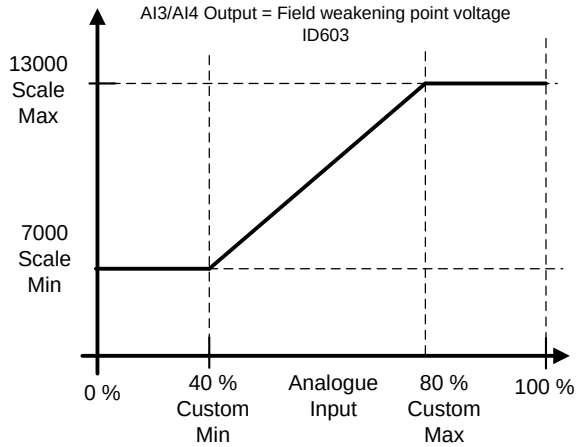
Example:

You want to control motor field weakening point voltage by analogue input from 70,00 % to 130,00 %.

Set Scale min to 7000 = 70,00 %

Set Scale max to 13000 = 130,00 %

Set Controlled ID to 603 Voltage at filed weakening point



Now analogue input 3 signal 0 V to 10 V (0 mA to 20 mA) will control field weakening point voltage between 70,00 % - 130,00 %. When setting value, decimals are handled as integer.

7.4 Output Signals

7.4.1 Digital Outputs

2.4.1.1 Ready ID432

The DC-DC drive is ready to operate.

2.4.1.2 Running ID433

The AC drive operates (the drive is modulating).

2.4.1.3 Fault ID 434

Drive is in fault state

2.4.1.4 Fault, Inverted ID 435

No active faults.

2.4.1.5 Warning ID 436

Warning situation is active

2.4.1.6 FB DIN 1 Par ID ID 891
2.4.1.7 FB DIN 2 Par ID ID 892
2.4.1.8 FB DIN 3 Par ID ID 893
2.4.1.9 FB DIN 4 Par ID ID 894

With these parameters you can define the parameter to be controlled by using FB digital input.
Example:
All option board inputs are already in use, but you want to give a DI: External Fault 1 (ID405) and drive has a fieldbus board.

Set parameter ID892 (Fieldbus Digital Input 2) to 405. Now you are able to control External Fault 1 command from the fieldbus by Profibus control word (bit 11).

It is possible to control any parameter in the same way if values 0 = FALSE and 1 = TRUE are significant for that parameter. For example, P2.1.5 Parallel AFE (ID1501) can be switched on and off using this function (Parallel AFE: 0 = No, 1 = Yes).

2.4.1.10 Charge DC 1668

Digital output for DC-Link charge control

7.4.2 Analogue Outputs

P2.4.2.1 Iout 1 Signal ID464

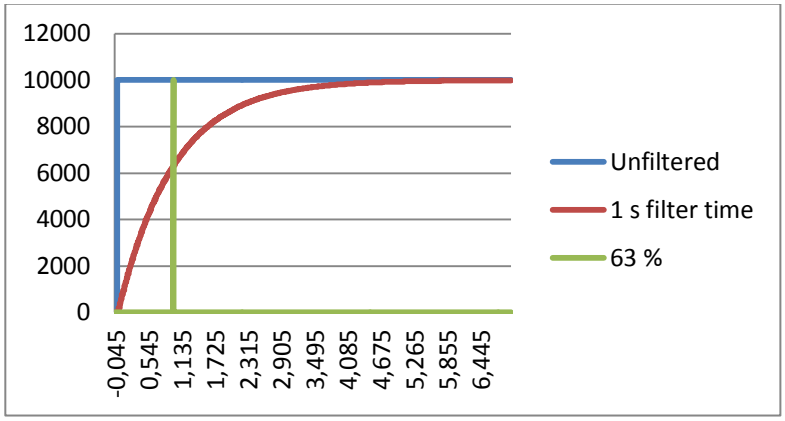
Connect the AO signal to the analogue output of your choice with this parameter.

P2.4.2.2 Iout 1 Content ID307

0 = Not used
1 = 2*Active Current

P2.4.2.3 Iout 1 Filter Time ID308

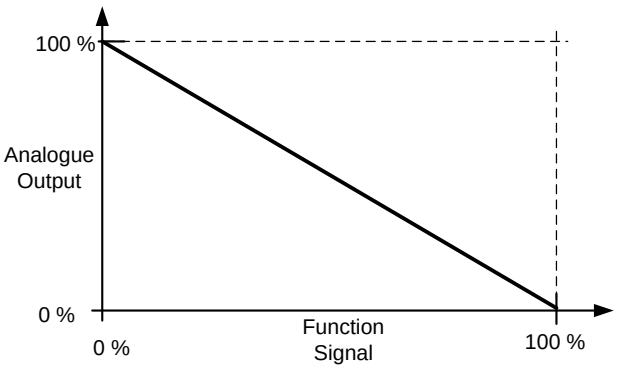
Defines the filtering time of the analogue output signal. Setting this parameter value 0 will deactivate the filtering. First order filtering is used for the analogue output signals.



P2.4.2.4 Iout 1 Invert ID309

Inverts the analogue output signal:

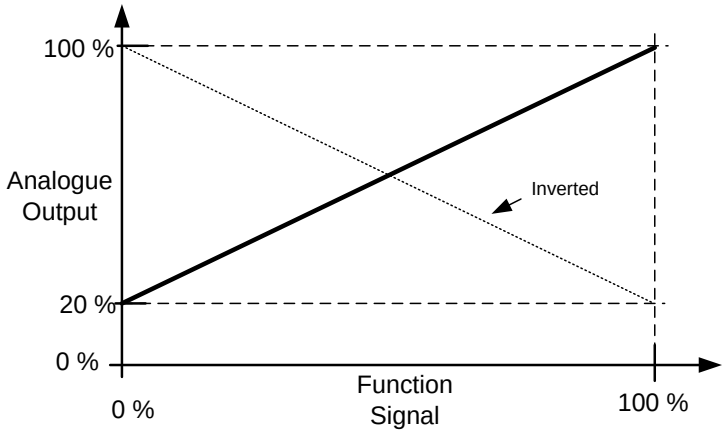
- Maximum output signal = Minimum set value.
- Minimum output signal = Maximum set value.



P2.4.2.5 Iout 1 Minimum ID310

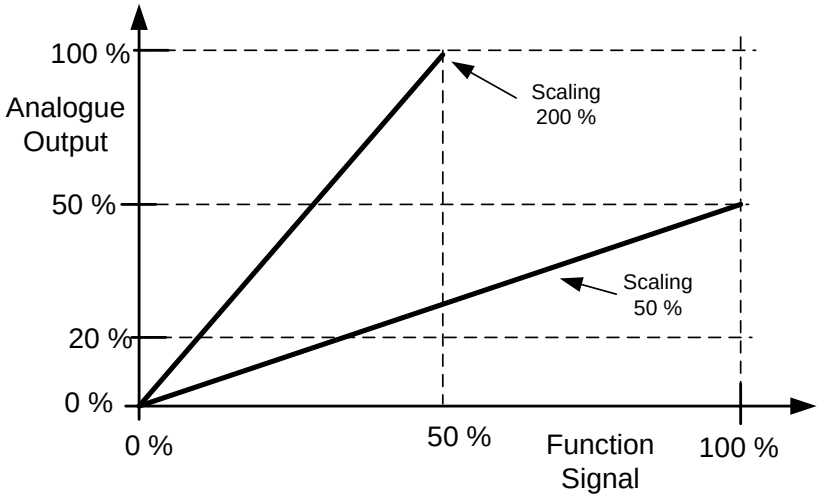
0 = Set minimum value to 0 mA (0%)

1 = Set minimum value to 4 mA (20%)



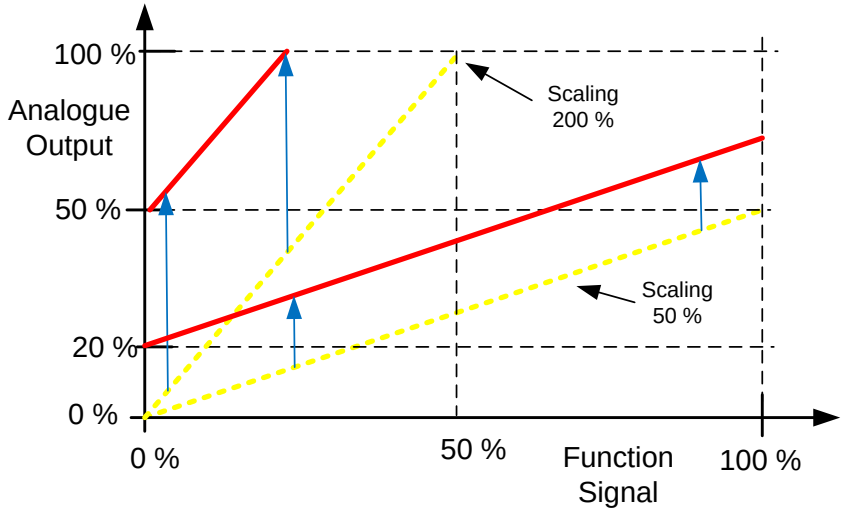
P2.4.2.6 Iout 1 Scale ID311

A scaling factor for an analogue output.



P2.4.2.7 Iout 1 Offset ID375

Add –100.0 to 100.0% to the analogue output.



7.5 Limit Settings

7.5.1 Current Limit

P2.5.1.1 Current Limit ID107

Current limit in amps.

P2.5.1.2 Charging Limit ID1290

Charging current limit in % of Source Nom Current

P2.5.1.2 Discharge Limit ID1289

Discharging current limit in % of Source Nom Current

7.5.2 Under Voltage Control

P2.5.2.1 Under Voltage Reference ID1567

Under voltage reference, % of unit nominal DC Voltage.

P2.5.2.2 Under Voltage Droop ID1863

P2.5.2.3 Under Voltage Kp ID1468

P2.5.2.4 Under Voltage Ti ID1409

P2.5.2.5 Under Voltage Kp Add ID1425

7.5.3 Over Voltage Controller

P2.5.2.1 Over Voltage Reference ID1528

Over voltage reference, % of unit nominal DC Voltage.

P2.5.2.2 Over Voltage Droop ID1862

P2.5.2.3 Over Voltage Kp ID699

P2.5.2.4 Over Voltage Ti ID698

P2.5.2.5 Over Voltage Kp Add ID697

7.6 Drive Control

P2.6.1	*Switching frequency*	*ID601*
P2.6.2	*Chopper Options*	*ID1463*
P2.6.3	*Over Modulation Limit*	*ID1515*
P2.6.4	*Advanced Options 1*	*ID1560*
P2.6.5	*Advanced Options 2*	*ID1561*
P2.6.6	*Advanced Options 3*	*ID1562*
P2.6.7	*Advanced Options 4*	*ID1563*
P2.6.8	*Advanced Options 5*	*ID1564*
P2.6.9	*Advanced Options 6*	*ID1565*
P2.6.10	*Inverse Synch*	*ID1857*
P2.6.11	*Control Options 1*	*ID1707*

7.6.1 Identification

2.6.11.1	*IU Offset*	*ID668*
2.6.11.2	*IV Offset*	*ID669*
2.6.11.3	*IW Offset*	*ID670*
2.6.11.4	*Source Resistance*	*ID662*

7.7 DC Control

P2.7.1 Current Control Kp ID617

P2.7.2 Current Control Ti ID657

P2.7.3 Voltage Control Kp ID1870

P2.7.4 Voltage Control Ki ID1871

7.8 Fieldbus parameters

2.8.1 FB Actual Sel

Select signal that is used as actual value from the drive.

2.8.2 GSW ID ID897

Select the value for FBGeneralStausWord

2.8.3 - 2.8.10 Fieldbus data out 1-8 selection ID852-ID859

Using these parameters, you can monitor any monitoring or parameter value from the fieldbus. Enter the ID number of the item you wish to monitor for the value of these parameters.

2.8.11 FB Ref Sel ID1850

2.8.12 - 2.8.19 Fieldbus data in 1-8 selection ID876-ID883

Using these parameters, you can control any parameter from the fieldbus. Enter the ID number of the item you wish to control for the value of these parameters.

P2.8.20 State Machine ID896

0 = Basic: This mode makes fieldbus control behave as in explained in used fieldbus board manual.
1 = Standard Simple control word that is used in modes where control word from fieldbus is used as such, for some fieldbus board this requires bypass operation.

7.9 Protections

2.9.1 FB Communication Response ID733

7.10 Keypad control

3.1 Control place ID1403

The active control place can be changed with this parameter.

NOTE! Keypad is the default control place.

0 = Fieldbus
1 = I/O terminal
2 = Keypad (Default)

8. FIELDBUS PROFILE FOR VACON DC-DC DRIVE

P2.8.20 State machine	
0 / Basic	This mode makes fieldbus control behave as in explained in used fieldbus board manual.
1 / Standard	Simple control word that is used in modes where control word from fieldbus is used as such, for some fieldbus board this requires bypass operation.
2 / Vacon DC-DC 1	This mode uses ProfiDrive type state machine in application level. This mode is possible to use on fieldbus boards that does not have state machine itself or has possibility to bypass state machine functionality in option board.
3 / Vacon DC-DC 2	This mode uses ProfiDrive type state machine in application level. This mode is possible to use on fieldbus boards that does not have state machine itself or has possibility to bypass state machine functionality in option board.

8.1 Basic In Bypass

	Main Control Word ID1160	
	Signal	Comment
B00	Run	**0**= DC-DC Drive is stopped **1**= DC-DC Drive is started
B01		
B02	Fault Reset	0>1 Reset fault.
B03	FB DIN1	Can be used to control RO or directly parameter by ID number. G2.4.1
B04	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B05	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B06	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B07		
B08		
B09		
B10		
B11		
B12		
B13		
B14		
B15		

8.2 Main Control Word

8.2.1 Standard

	Main Control Word ID1160	
	Signal	Comment
B00	DC Charge	**0**= - **1**= Charge DC
B01		
B02		
B03	Run	**0**= AFE is stopped **1**= AFE is started
B04		
B05		
B06		
B07	Reset	0>1 Reset fault.
B08		
B09		
B10	PLC Control	**0**= Disable FB Control **1**= Enable FB Control
B11	FB DIN1	Can be used to control RO or directly parameter by ID number. G2.4.1
B12	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B13	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B14	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B15		

B00: FALSE = Reserved, TRUE = Charge DC
Reserved: No Function, but will stop the drive.
Charge DC: Activates charging DO, will charge maximum 10 second, will stop earlier if DC CB feedback is received.

B03: FALSE = Stop Request, TRUE = Start Request
Stop Request: Drive will stop .
Start Request: Start Command to the drive. Rising edge needed for start.

B07: FALSE = No significance, TRUE = Fault Acknowledge

Fault Acknowledge: The group signal is acknowledged with a positive edge.

B10: FALSE = Disable FB Control, TRUE = Enable FB Control
Disable FB Control: Drive will stop .
Enable FB Control: Start Command is monitored from fieldbus.

8.2.2 Vacon DC-DC 1 profile

	Main Control Word ID1160	
	Signal	Comment
B00	DC Charge	0= 1= Charge DC
B01		
B02		
B03	Run	0= AFE is stopped 1= AFE is started
B04		
B05		
B06		
B07	Reset	0>1 Reset fault.
B08	DC Voltage Ref B00	B00 | B01 0 | 0 = FB Reference. P2.2.1, if not FB Control & FB Ref > 50,00 % 0 | 1 = 110 % 1 | 0 = 115 % 1 | 1 = 120 %
B09	DC Voltage Ref B01	
B10	Fieldbus Control	0= No control from fieldbus 1=Control from fieldbus
B11	Watchdog	0>1>0>1...0,5 sec square wave clock. This is used to check data communication between fieldbus master and the drive.
B12	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B13	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B14	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B15		Reserved for future use.

B00: FALSE = Open MCB, TRUE = PreCharge DC
Open MCB: Opens main circuit breaker if closed, stops precharging if not closed.
PreCharge DC: Drive will start precharge if function activated by digital output and control place is fieldbus. When control place is not fieldbus precharging is started from normal start command.

B03: FALSE = Stop Request, TRUE = Start Request
Stop Request: Drive will stop .
Start Request: Start Command to the drive. Rising edge needed for start.

B07: FALSE = No significance, TRUE = Fault Acknowledge

Fault Acknowledge: The group signal is acknowledged with a positive edge.

B08: FALSE = No Function, TRUE = DC Ref 1

B09: FALSE = No Function, TRUE = DC Ref 2

DC Ref	FB Reference	110,00 %	115,00 %	120,00 %
B08	FALSE	TRUE	FALSE	TRUE
B09	FALSE	FALSE	TRUE	TRUE

B10: FALSE = FB Control disabled TRUE = FB Control Enabled

FB Control Disabled: Drive will not follow main control word from Fieldbus. If removed while running drive will stop.
FB Control Enabled: Drive follows control word from fieldbus

B11: FALSE = FB WD Pulse Low, TRUE = FB WD Pulse High

Watch Dog pulse: This pulse is used to monitor that PLC is alive. If pulse is missing drive will go to fault state. This function is activated by P2.7.6 FB WD Delay. When value is zero pulse si not monitored.

8.2.3 Vacon DC-DC 2 Profile

	Main Control Word ID1160	
	Signal	Comment
B00	DC Charge	0= Open main CB. 1= Close DC charge contactor, CB closed automatically, see B01.
B01	CB Close Enable	0= Disable Closing of CB 1= Enable Closing if CB
B02	Forced Restart	0= Forced Restart, DC need to go zero before new DC charge. 1= Enable Operation
B03	Run	0= AFE is stopped 1= AFE is started
B04	Floating DC Ref	0= Enable floating DC Reference 1= Disable floating DC Reference
B05	DC Drooping	0= Disable DC Drooping (DC Droop 2) 1= Enable DC Drooping (DC Droop 1)
B06	Power Limit	0= Power Limited (5 %) 1= Power Limit set by parameters
B07	Reset	0>1 Reset fault.
B08	DC Voltage Ref B00	B00 | B01 0 | 0 = FB Reference. P2.2.1, if not FB Control & FB Ref > 50,00 % 0 | 1 = 110 % 1 | 0 = 115 % 1 | 1 = 120 %
B09	DC Voltage Ref B01	
B10	Fieldbus Control	0= No control from fieldbus 1=Control from fieldbus
B11	Watchdog	0>1>0>1...0,5 sec square wave clock. This is used to check data communication between fieldbus master and the drive.
B12	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B13	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B14	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B15		Reserved for future use.

B00: FALSE = Open MCB, TRUE = PreCharge DC
Open MCB: Opens main circuit breaker if closed, stops precharging if not closed.
PreCharge DC: Drive will start precharge if function activated by digital output and control place is fieldbus. When control place is not fieldbus precharging is started from normal start command.

B01: FALSE = (OFF 2), TRUE =

Coast Stop:
ON 2:

B03: FALSE = Stop Request, TRUE = Start Request
Stop Request: Drive will stop .
Start Request: Start Command to the drive. Rising edge needed for start.

B07: FALSE = No significance, TRUE = Fault Acknowledge

Fault Acknowledge: The group signal is acknowledged with a positive edge.

B08: FALSE = No Function, TRUE = DC Ref 1

B09: FALSE = No Function, TRUE = DC Ref 2

DC Ref	FB Reference	110,00 %	115,00 %	120,00 %
B08	FALSE	TRUE	FALSE	TRUE
B09	FALSE	FALSE	TRUE	TRUE

B10: FALSE = FB Control disabled TRUE = FB Control Enabled

FB Control Disabled: Drive will not follow main control word from Fieldbus. If removed while running drive will make coasting stop.
FB Control Enabled: Drive follows control word from fieldbus

B11: FALSE = FB WD Pulse Low, TRUE = FB WD Pulse High

Watch dog pulse: This pulse is used to monitor that PLC is alive. If pulse is missing drive will go to fault state. This function is activated by P2.7.6 FB WD Delay. When value is zero pulse si not monitored.

8.3 Main Status Word

	Signal	Comment
b0	Ready On	0=Drive not ready to switch on 1=Drive ready to start charging
b1	Ready Run	0=Drive not ready to run 1=Drive ready and Main Contactor is ON
b2	Running	0=Drive not running 1=Drive in Run state (Modulating)
b3	Fault	0=No active fault 1=Fault is active
b4	Run Enable Status	0= Run Disabled. Drive in stop state 1= Run Enabled. Drive can be started.
b5	Quick Stop Active	0=Quick Stop Active 1=Quick Stop not Active
b6	CB Control OK	0= Status opposite of control 1= Status and control OK
b7	Warning	0= No active warnings 1= Warning active
b8	At Reference	0= DC Voltage Ref and Act DC Voltage are not same.
b9	Fieldbus Control Active	0=Fieldbus control not active 1=Fieldbus control active
b10	Above Limit	0= DC Voltage is below P2.5.5.1 level 1=The DC Voltage is above the P2.5.5.1 level
b11		Reserved for future use.
b12		Reserved for future use.
b13		Reserved for future use.
b14	DC Charge DO Control	0= DC not charged 1= DC Charging Active
b15	Watchdog	Same as received on bit 11 of the main control word.

B00: FALSE = Not Ready to Switch On, TRUE = Ready to Switch On
Not Ready to Switch On: Fault active, DI: Run Enable low,
Ready to Switch On: No Faults, DI: Run Enabled,

B01: FALSE = Not Ready To Operate, TRUE = Ready To Operate
Not Ready To Operate: CW.B0 = FALSE, DC Not Ready,.
Ready To Operate: CW.B0 = TRUE, DC Ready,

B02: FALSE = Drive is not operating, TRUE = Drive is operational
Drive is not operating: Drive is not run state (modulating)
Drive is operational: Drive is in run state and modulating.

B03: FALSE = No Fault, TRUE = Fault Present
No Fault: Drive is not on fault state.
Fault Present: Drive is in fault state.

B04: FALSE = Coast Stop Activated, TRUE = Coast Stop Not Activated
Coast Stop Activated: DI: Run Enable False, Quick Stop Active, MCB Status Open, MCB Control Open, Enable CB Close, MCB Forced Open.
Coast Stop Not Activated: Running Enabled

B05: FALSE = Quick Stop Activated, TRUE = Quick Stop Not Activated
Quick Stop Activated: Quick Stop command is active.
Quick Stop Not Activated: Quick stop command is not active.

B06: FALSE = CB Control OK, TRUE = CB Control Not OK
CB Control OK: CB Control and Drive internal status are the same.
CB Control Not OK: Drive internal status to close the circuit breaker is high but application logic request circuit breaker open. This can be case when CB has been opened but DC is connected to battery system. DC needs to be discharged or CB is needed to close.

B07: FALSE = No Warning, TRUE = Warning Present
No Warning: There is no warning or the warning has disappeared again.
Warning Present: Drive still works; warning in the service/maintenance parameter; no acknowledgement.

B08: FALSE = DC Voltage out of tolerance TRUE = DC Voltage within tolerance
DC Error Out Of Tolerance Range:
DC Error Within Tolerance Range:

B09: FALSE = No Control Requested, TRUE = Control Requested
No Control Requested: Control by the automation system is not possible.
Control Requested: The automation system is controlling.

B10: FALSE = DC Not Reached, TRUE = DC Reached Or Exceeded
DC Not Reached: DC Voltage is below P2.5.5.1 level
DC Reached Or Exceeded: DC Voltage is above the P2.5.5.1 level

B14: FALSE = Charge DO Open, TRUE = Charge DO Closed
Charge DO Open: Charging Command not active
Charge DO Closed: Charging Command Active

B15: FALSE = FB DW Feedback Low, TRUE = FB DW Feedback High
FB DW Feedback: FB Control Word B11 is echoed back to the Fieldbus. Can be used to monitor communication status from the drive.

8.4 Fault Word 1

	Fault Word 1	
	Fault	Comment
b0	Over Current	F1
b1	Overvoltage	F2
b2	Under voltage	F9
b3	Not used	
b4	Earth Fault	F3
b5	Not used	
b6	Unit Over Temperature	F14
b7	Over Temperature	F59, F56,F71
b8	Input Phase loss	F11
b9	Not used	
b10	Device Fault	F37,0 F38, F39, F40, F44, F45
b11	Not used	
b12	Not used	
b13	Not used	
b14	Not used	
b15	Not used	

Table 8-9. Fault Word 1

8.5 Fault Word 2

	Fault Word 2	
	Fault	Fault Codes
b0	Not used	
b1	Charging Switch Fault	F5
b2	Not used	
b3	Drive Hardware fault	F4, F7
b4	Under Temperature	F13
b5	EPROM or Checksum fault	F22
b6	External fault	F51
b7	Not used	
b8	Internal Communication	F25
b9	IGBT Temperature	F31,0F41
b10	Not used	
b11	Cooling fan	F32, F70
b12	Application fault	F35
b13	Drive Internal fault	F33, F36,F8, F26
b14	Main Switch open	F64
b15	Not used	

Table Fault Word 2

8.6 Warning Word 1

	Warning Word 1	
	Warning	Warning Codes
b0	Not used	
b1	Temperature protection	W29: Thermistor warning, W56: FPT100 warning or W71: LCL over temperature warning
b2		
b3	Supply Phase Warning	W11
b4	Not used	
b5	Not used	
b6	Not used	
b7	Drive over temperature	W14
b8	Not used	
b9	Not used	
b10	Fan Warning	W32: Fan Cooling W70: LCL Fan monitor warning
b11	Not used	
b12	Not used	
b13	Not used	
b14	Not used	
b15	Not used	

Table 8. Alarm Word 1

8.7 Auxiliary Control Word

	FALSE	TRUE
b0		Reserved for future use.
b1		Reserved for future use.
b2		Reserved for future use.
b3		Reserved for future use.
b4		Reserved for future use.
b5		Reserved for future use.
b6		Reserved for future use.
b7		Reserved for future use.
b8		Reserved for future use.
b9		Reserved for future use.
b10		Reserved for future use.
b11		Reserved for future use.
b12		Reserved for future use.
b13		Reserved for future use.
b14		Reserved for future use.
b15		Reserved for future use.

8.8 Status Word (Application) ID 43

Application Status Word combines different drive statuses to one data word.

	Application Status Word ID43	
	FALSE	TRUE
b0		
b1	Not in Ready state	Ready
b2	Not Running	Running
b3	No Fault	Fault
b4		
b5		
b6	Run Disabled	Run Enable
b7	No Warning	Warning
b8		Charging Switch closed (internal)
b9		Over Voltage Controller Active
b10		Under Voltage Controller Active
b11		
b12	No Run Request	Run Request
b13		
b14		
b15		

B01: FALSE = Not Ready, TRUE = Ready
Not Ready: DC Voltage low, Fault active
Ready: Drive in ready state, start command can be given.

B02: FALSE = Not Running, TRUE = Running
Not Running: Drive is not modulating
Running: Drive is modulating.

B03: FALSE = No Fault, TRUE = Fault Active
No Faults: Drive do not have active faults.
Fault: Drive has an active faults.

B06: FALSE = Run Enable Low, TRUE = Run Enable High
Run Enable Low: Run Enable command to motor control is low
Run Enable High: Run Enable command to motor control is high.

B07: FALSE = No Warning, TRUE = Warning Active
No Warning: No warning signals active in the drive
Warning: Drive has active warning signal. Warning signal not stop the operation.

B08: FALSE = Charging Switch Open, TRUE = Charging Switch closed
Charging Switch Open: DC voltage level is nor reached closing level or has drop below the opening level. This information is from drive motor control.
Charging switch Closed: DC voltage level is above closing limit and no interlock active internally.

B09: FALSE = , TRUE =
x: x.
x: x.

B10: FALSE = x, TRUE = x
x: x.
x: x.

B11: FALSE = x, TRUE = x
x: x.
x: x.

B12: FALSE = No Run Request, TRUE = Run Request
No Run Request: Final Run Request command has not been given to motor control.
Run Request: Final Run Request command has been given to motor control.

9. RECOMMENDED SIGNALS FOR MONITORING

9.1 Monitoring Window in NCDrive

For NCDrive when using RS232 communication it's recommended to use fastest communication speed and fastest update interval. Baud rate: 57600 and Sampling Interval: 50 ms. For CAN monitoring Speed 1 Mbit and usually 3-14 ms sampling interval depending how long trend is needed to take.

1. Value: Status Word
2. Value: DC Voltage
3. Value: Active Current
4. Value: Source Voltage
5. Value: Current
6. Value: DC-Link Current
7. FW: PosIqcurrentLim
8. FW: NegIqcurrentLim

9.2 Datalogger signals in NCDrive

With NXP3, NCDrive Version 2.0.17 and System Software version V186 16 signals can be recorded to datalogger.

1. Firmware: IU_CurrentMotor
2. Firmware: IV_CurrentMotor
3. Firmware: IW_CurrentMotor
4. Firmware: DCVoltageUnFiltered
5. Firmware: FreqOut
6. Keypad: Status Word
7. Firmware: MotorCurrentUnFiltered
8. Firmware: IdActual
9. Firmware: IqActual
10. Firmware: MotorVoltage
11. Firmware: Mindex
12.
13.
14.
15.
16.

9.3 NCDrive use

Parameters need to be stored while NCDrive is online. Preferably when situation is active, if possible but at least immediately after situation has happened e.g. after F1 Over Current fault.

10. FAULT CODES

The fault codes, their causes and correcting actions are presented below.

Note: When contacting distributor or factory because of a fault condition, always write down all texts and codes on the keypad display. Best way is to send parameter file and service info to Vacon technical support
This chapter includes all fault codes that are possible. but some faults are not possible in AFE application. And some faults description may be different when compared to standard frequency converter.

F1 Over current fault

Drive has detected a high current in the output phase.

S1 = Hardware trip:
Current above 4*Ih

Possible cause and solutions

1. Sudden increase in load
   - Check motor load.
2. Short circuit in cables
   - Check cables.

F2 Overvoltage fault

DC-link voltage has exceeded the drive protection limits.

S1 = Hardware trip.
500 Vac unit DC voltage above 911 Vdc
690 Vac unit DC voltage above 1200 Vdc
S2 = Overvoltage control supervision (only 690 Vac unit).
DC voltage has been above 1100 Vdc for too long.

Possible cause and solutions

1. Too short a deceleration time
   - Increase deceleration time.
   - Use brake chopper and brake resistor.
   - Use Brake chopper unit.
2. High overvoltage spikes in supply
   - Check input voltage.

F3 Earth fault

Earth fault protection ensures that the sum of the phase currents is zero. The over current protection is always working and protects the frequency converter from earth faults with high currents.

S1 = Sum of output phase current is not zero

Possible cause and solutions

1. Insulation failure in cables

F5 Charge switch

Charge switch status is not correct when start command is given.

S1 = Charge switch was open when START command was given.

Possible cause and solutions

2. Charge switch was open when the START command was given.
    - Check connection of the feedback from charging relay
3. Reset the fault and restart.

Should the fault re-occur, contact your local distributor.

F7 Saturation fault

S1 = Hardware failure

- Cannot be reset from the keypad.
- Switch off power.
- DO NOT RE-CONNECT POWER!
- Contact your local distributor.

F8 System Fault

A system fault indicates several different fault situations in drive operation.

S1 = Reserved

4. Disturbance. Reset the unit and try again.
5. If there is star coupler in the unit, check the fibre connections and phase order.
6. Driver board or IGBT broken.
7. FR9 and the bigger size drives , which includes not star coupler, ASIC board (VB00451) is broken.
8. FR8 and smaller size drives: control board broken.
9. FR8 and smaller size drives: if there is boardsVB00449 / VB00450 in use,failure might be in there.

S2 = Reserved
S3 = Reserved
S4 = Reserved
S5 = Reserved
S6 = Reserved
S7 = Charge switch
S8 = No power to driver card
S9 = Power unit communication (TX)
S10 = Power unit communication (Trip)
S11 = Power unit comm. (Measurement)
S12 = SystemBus synchronization has failed in DriveSynch operation
S30 = Safe disable inputs are in different state (OPT-AF)
S31 = Thermistor short circuit detected (OPT-AF)
S32 = OPT-AF board has been removed
S33 = OPT-AF board EEPROM eror

F9 Undervoltage fault

DC-link voltage is below the fault voltage limit of the drive.

S1 = DC-link too low during run
S2 = No data from power unit
S3 = Undervoltage control supervision

Possible cause
1. Too low a supply voltage
2. Frequency converter internal fault
3. One of the input fuses is broken.
4. External charge switch has not been closed.

Correcting measures
1. In case of temporary supply voltage break, reset the fault and restart the frequency converter.
2. Check supply voltage.
3. Check function of DC charge.
4. Contact your local distributor.

F10 Line Synchronization Fault

S1 = Phase supervision diode supply
S2 = Phase supervision active front end

Possible cause:
1. Input line phase is missing.

Correcting measures
1. Check supply voltage, fuses and cable.

F11 Line phase supervision

Current measurement has detected that there is no current in one phase or one phase current is considerably different from other phases.

Correcting measures
1. Check cables

F13 Drive under temperature fault

Possible cause:
1. Heatsink temperature is under −10°C

F14 Drive over temperature fault

Possible cause:
1. Heatsink temperature is over acceptable limits. See user's manual for the temperature limit. Overtemperature warning is issued before actual trip limit is reached.

Correcting measures
1. Check correct amount and flow of cooling air.
2. Check the heatsink for dust.
3. Check ambient temperature.
4. Make sure that switching frequency is not too high in relation to ambient temperature and motor load.

F22 EEPROM checksum fault

Possible cause:
1. Parameter save fault
2. Faulty operation
3. Component failure

Correcting measures:
1. Should the fault re-occur, contact your local distributor.

F24 Counter fault

Possible cause:
1. Values displayed on counters are incorrect

Correcting measures:
1. Have a critical attitude towards values shown on counters.

F25 Microprosessor watchdog fault

Possible cause:
1. Start-up of the drive has been prevented.
2. Run request is ON when a new application is loaded to the drive.

Correcting measures:
1. Reset the fault and restart.
2. Should the fault re-occur, contact your local distributor.

F26 Start-Up prevention

Possible cause:
1. Start-up of the drive has been prevented.
2. Run request is ON when a new application is loaded to drive

Correcting measures:
1. Cancel prevention of start-up if this can be done safely.
2. Remove Run Request.

F29 Thermistor fault

The thermistor input of the option board has detected too high a motor temperature.

Possible cause:
1. Motor is overheated.
2. Thermistor cable is broken.

Correcting measures:
1. Check motor cooling and load
2. Check thermistor connection(If thermistor input of the option board is not in use it has to be short circuited).

F31 IGBT temperature

IGBT Inverter Bridge over temperature protection has detected too high a short term overload current.

Possible cause:

1. Too high load
2. Identification run has not been made which causes the motor to start under magnetized.

Correcting measures:

1. Check load.
2. Check motor size.
3. Make identification Run.

F32 Fan cooling

Possible cause:

1. Cooling fan of the frequency converter does not start when ON command is given.

Correcting measures:

1. Contact your local distributor.

F37 Device change

Option board or power unit changed.

Possible cause:

1. New device of same type and rating.

Correcting measures:

1. Reset. Device is ready for use.

F38 Device added

Option board added.

Correcting measures:

1. Reset. Device is ready for use. Old board settings will be used.

F39 Device removed

Option board removed.

Correcting measures:

1. Reset. Device no longer available.

F40 Device unknown

Unknown option board or drive.

S1 = Unknown device
S2 = Power1 not same type as Power2

Correcting measures:

1. Contact the distributor near to you.

F41 IGBT temperature

IGBT inverter bridge overtemperature protection has detected too high a short term overload current.

Correcting measures:

1. Check load.

F44 Device changed (Default param.)

Possible cause:

1. Option board or power unit changed.
2. New device of different type or different rating from the previous one.

Correcting measures:

1. Reset
2. Set the option board parameters again if option board was changed. Set converter parameters again if power unit was changed.

F45 Device added (default param.)

Possible cause:

1. Option board of different type added.

Correcting measures:

1. Reset
2. Set the option board parameters again.

F50 4mA supervision

Possible cause:

1. Current at the analogue input is below 4mA.
2. Signal source has failed
3. Control cable is broken or loose

Correcting measures:

1. Check the current loop circuitry.

F51 External fault

Possible cause:

1. Digital input fault.

Correcting measures:

1. Remove fault situation from external device.

F52 Keypad communication

Possible cause:

1. The connection between the control keypad or NCDrive and the AC drive is broken.

Correcting measures:

1. Check keypad connection and possible keypad cable.

F53 Fieldbus communication

Possible cause:

1. The data connection between the fieldbus Master and the fieldbus board is broken.

Correcting measures:

1. Check installation.
2. If installation is correct contact the nearest Vacon distributor.

F54 Slot fault

Possible cause:

1. Defective option board or slot

Correcting measures:

1. Check board and slot.
2. Contact the nearest Vacon distributor.

F56 PT100 temperature fault

PT100 protection function is used to measure temperature and give warning and/or fault when set limits are exceeded. Marine application supports two PT100 boards. One can be used for the motor winding and the other for the motor bearings.

Possible cause:

1. Temperature limit values set for the PT100 board parameters have been exceeded

Correcting measures:

1. Find the cause of temperature rise

F60 Cooling

Protection for the liquid-cooled units. An external sensor is connected to the drive (DI: Cooling Monitor) to indicate if cooling liquid is circulating. If the drive is in Stop state only a warning is issued. In Run state a fault is issued and the drive makes a coast stop.

Possible cause:

1. Liquid cooled drive cooling circulation have been failed

Correcting measures:

1. Check reason for cooling failure from external system.

F62 Run Disabled

Run Disable warning signal is issued when Run Enable signal has been removed from the IO.