Nederman®
Improving your workspace

ENGLISH

NO. 148 383 02

2001-08-20

Fan Inverter

INSTRUCTION MANUAL

List of contents

Nederman®

This product is designed to meet the requirements of the relevant EC directives. To maintain this status all installation, repair and maintenance work must be carried out by qualified personnel using only original spare parts. Contact your nearest authorised dealer or
AB Ph. Nederman & Co. for advice on technical service or if you require spare parts.

Declaration of conformity

We, AB Ph. Nederman & Co., declare under our sole responsibility that the Nederman product:
Fan Inverter
Part. No 14511837, 14511937, 14512037, 14512137, 14512237, 14512637,14515137,14515237,14515337,14515437
to which this declaration relates, are in conformity with
the following standards or other normative documents:
EN 61800-3, EN 50 082-2, EN 60 439-1
following the provisions of Directive
89/336/EEC, 93/68/EEC, 73/23/EEC

AB Ph. Nederman & Co.
Sydhamnsgatan 2
S-252 28 Helsingborg Sweden
2001-08-10

_____
Alf Jonasson, Product Manager

SAFETY

Warning! Only a competent electrician may install the Fan Inverter.

Warning! Dangerous voltages are present when mains supply is connected. Wait at least 5 minutes after disconnecting the supply before removing the cover. Measure the voltage at DC terminals (Uc+ , Uc-) before servicing the unit. See E.[1]

Warning! Even when the motor is stopped there are dangerous voltages present at Power Circuit terminals U1, V1 and W1 and also between U2, V2, W2 and U c+ and U c- .

Warning! Even when the Fan Inverter is powered down, there may be dangerous external voltages at relay terminals RO1A, RO1B, RO1C, RO2A, RO2B, RO2C.

Warning! Never attempt to repair a broken unit; contact the supplier..

Warning! Fan Inverter will start up automatically after an input voltage interruption if the external run command is on.

Warning! When the control terminals of two or more Fan Inverter units are connected in parallel, the auxiliary voltage for these control connections must be taken form a single source, which can either be one of the units or an external supply.

Warning! The heat sink may reach a high temperature (see S, Table 11[1])

Warning! If the supply network is floating (IT network) do not use RFI filter. The mains becomes connected to earth through the filter capacitors. In floating networks this may cause danger or damage the unit. See H.[1]

Note! For more technical information, contact the supplier.

[1] ABB User's Manual is attached with the delivery.

TECHNICAL DATA

Fan Inverter		**3**	**4**	**5,5**	**7,5**	**11**	**15**	**18.5**	**22**	**30**	**37**
Part. No		**14511837**	**14511937**	**14512037**	**14512137**	**14512237**	**14512637**	**14515137**	**14515237**	**14515337**	**14515437**
Power	kW	3	4	5,5	7,5	11	15	18,5	22	30	37
Type	ABB ACS 401	-004-3-5	-005-3-5	-006-3-5	-009-3-5	-011-3-5	-016-3-5	-020-3-5	-025-3-5	-030-3-5	-041-3-5
Input		380V - 480V ±10% 48 - 63 Hz, 3~ (+N at 400V to receive 230V to extern equipment)									
Protection class		IP 54, No conductive dust allowed, see "A" in ABB User's Manual									
Control voltage		24 V DC, 250 mA									
Pressure transducer	kPa	max 3,0									
Frame size		R1			R2		R3		R4		
RFI-filter	ACS401-	-IF11-3			-IF21-3		-IF31-3		-IF41-3		
Input current I_{1NSQ}	A	6,2	8,3	11,1	14,8	21,5	29	35	41	56	68
Output current I_{2NSQ}	A	6,6	8,8	11,6	15,3	23	30	38	44	59	72
Line fuse*	A	10 (16)	10 (16)	16 (25)	16 (25)	25 (35)	35 (50)	50	50	63	80
Supply to external equipment	at 400V 3~+N	230 V AC max 6 A, accessories 12372075 and 12371984 have to be connected									
Dimension H x B x D	mm	450 x 215 x 300, with RFI filter			550x215x315, with RFI filter		642 x 257 x 280 **		742 x 257 x 312 **		
Weight with RFI-filter	kg	10			14		22,3**		32,3**		
Suitable Nederman Fan	400V 50Hz / 460V 60Hz	N29 N40 NCF 30/15	NCF 30/25	NCF 40/25	NCF 50/25 80/15 80/25*** 120/15	NCF 80/25 120/25***	NCF 120/25 160/25***	NCF 160/25			

* Fuse type: UL class CC or T. For non-UL installations IEC269 gG. When additional fuse installed, accessory 12371984, use value between brackets.

** Dimensions without RFI filter, to be mount separately: IF31: 500 x 170 x 80 , 8 kg; IF41: 550 x 200 x 80, 11,5 kg.

*** In many applications the maximum fan power outtake is not required and gives the possibility to use one size smaller Fan Inverter.

Note! Use 60C rated power cable (75C if ambient temperature exceeds 45C).

Note! The maintenance/safety switch, if installed, can be used only as a safety device. Do not operate (close) the switch when the Fan Inverter is running. The signal contact in the switch have to be connected to “run enable”, terminal X1 8 - 14, or void warranty.

Fan Inverter is suitable for use in a circuit capable of delivering not more than 65 kA rms symmetrical amperes, 480 V maximum.

SYSTEM DESCRIPTION

The Nederman Fan Inverter is a frequency controller for Nederman NCF fans.
Equipped with a pressure transducer and the built-in PID controller it can maintain a constant negative pressure in an extraction system and by this almost a constant airflow in the extraction devices. The fan capacity is regulated to the actual demand of the airflow, depending on the number of extraction points in use at the same time.

The benefit of using the inverter is primarily in the conservation of energy. Achieved from reduced running costs, lower heat loss to atmosphere and reduced noise levels. All of these points relate to the general day to day usage of the system as the demand increases/decreases.
The inverters integral control transducer senses the system pressure taken from the farthest point in the duct system or at the extraction point which offers most pressure drop.

The system can be started with the 1/0 button on the control panel, in local mode "LOC" or by an optional potential free remote contact in the remote mode "REM" which is recommended. The system has more protection abilities in “REM”-mode.
The remote start is used when the Fan Inverter is combined with FILTERMAX or a Fan Timer or a remote start switch. In combination with extractor arms with spotlight the automatic damper or a voltage separation relay have to be used to get the potential free contact.
When connected to FILTERMAX and in REM-mode, the Fan Inverter is the "slave" with the FILTERMAX used as the “master”. The start button, on FILTERMAX control box, then starts the system. An other possibility is to start from a remote potential free contact or a Fan Timer connected to FILTERMAX control box.

THE FAN

When a fan is frequency controlled a constant pressure can be achieved in the whole working range of the fan, up to the fan maximum frequency.

The power consumed follows proportionally as a cube, i.e. as the fan R.P.M. is reduced by half so the power is reduced to an 1/8th, see diagram 2. Although the cooling effect from the motor cooling fan is reduced when the R.P.M. is decreased, the power consumption is reduced even more and there is no risk of overheating by reducing the frequency.

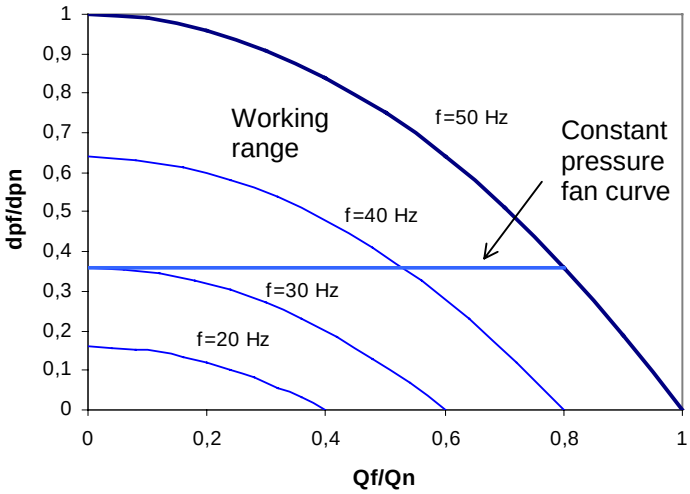


Diagram 1. Fan curve changed by frequency

For Nederman fans the maximum frequency is normally the fan nominal frequency, i.e. 50 or 60 Hz. Above these frequencies too much mechanical stress is imposed on the impeller which could be detrimental with failure occurring.

In many applications the maximum fan power outtake is not required and gives the possibility to use one size smaller Fan Inverter, for NCF 80/25, 120/25 and 160/25.
By estimation of the maximum fan power consumption for the actual working range in your application, using NedQuote as an aid, a Fan Inverter with at least the same power can be selected.

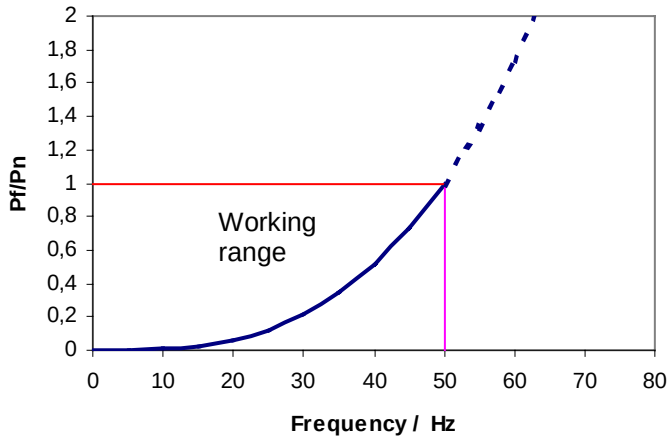


Diagram 2. Relative power consumption versus frequency, (nominal frequency 50 Hz)

INSTALLATION

Study the Safety instructions on page 4. Study the installation instructions given in this document and in the ACS 400 user's manual and the ACS 400 EMC instructions carefully before proceeding.
Failure to observe the warnings and instructions given may cause a malfunction or personal hazard.

Note the need of shielded cables for the motor and control.

Dimension the cables and fuses in accordance with the Inverter and motor current.
Always pay attention to local legislation when sizing the cables and fuses. See table "Technical data" on page 5 for Line fuse rating

A main switch shall be installed on the power supply for the Fan Inverter. A 4th pole for neutral and a fuse is needed if the same main switch, (with supply 400V 3Ph +N), supplies FILTERMAX or other 230 V single-phase equipment. See "Mains interconnection diagram".
If the power supply network also supplies buildings used for domestic purposes the Fan Inverter has to be equipped with a RFI filter. This is not needed if the system has an intermediate transformer but is recommended to avoid problems with sensitive equipment.
The Fan Inverter is delivered with RFI filter as standard.

If the supply network is floating (IT network) do not use RFI filter. The mains becomes connected to earth through the filter capacitors. In floating networks this may cause danger or damage the unit. See H[1].

Due to a leak current to ground from the RFI filter at power on, approx. 100 mA, the Fan Inverter can not be connected to a supply with GFI (Ground Fault Interrupter) for a lower leakage current rate.

Up to Fan Inverter 11 the RFI filter ACS400-IFX1-3 is first to be mounted on the wall and then the unit is mounted upon the RFI filter. For Fan Inverter 15 the RFI filter is mounted separately. With terminal cover it has an IP54 protection class. For RFI-filter ACS400-IF41-3 (>= 22kW) a choke, ACS-CHK-A included, must be mounted around the motor cable, maximum 0,5 m from the unit.

If the fan is located in another location then the main switch, a maintenance switch with signal contact should be used. The signal contact has to be connected to "run enable, terminal X1 8-14, or this voids the warranty. Due to the RFI emission risk the switch has to be of a RFI protected type and the cable shield must be connected. Use cable glands at the motor for shielded cables.

[1] ABB User instruction is attached with the delivery.

Fig 1 Installation Fan Inverter
Supply: 400V 3/N, PE, 50 Hz

Fuse 6 A , connected to output side from main switch. Accessory

Main switch for the System 3 +N (separate block) Accessory.

Voltage separation relay, Has to be installed if the Fan Inverter is controlled from the switch on the hood,(alt. autom. damper) Accessory.

Fan Timer
For automatic start and stop. Accessory Recommended!

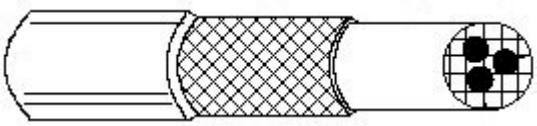
Fan Inverter mounted on the RFI filter, (up to 11 kW)

External warning label, can be placed by you.
(English label not supplied, already placed inside, see fig 2)

Shielded Motor cable
(choke, only for RFI-filter ACS 400-IF41-3)

Keep cables at >= 0,2 m distance to the inverter and motor cable

Shielded Motor cable



Maintenance switch
Do not forget to connect the signal contact with shielded cable to the Fan Inverter

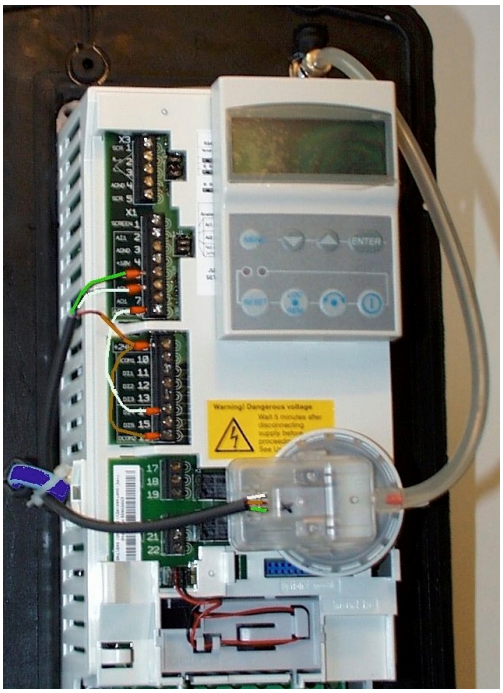


Fig 2 Fan Inverter up to 11 kW

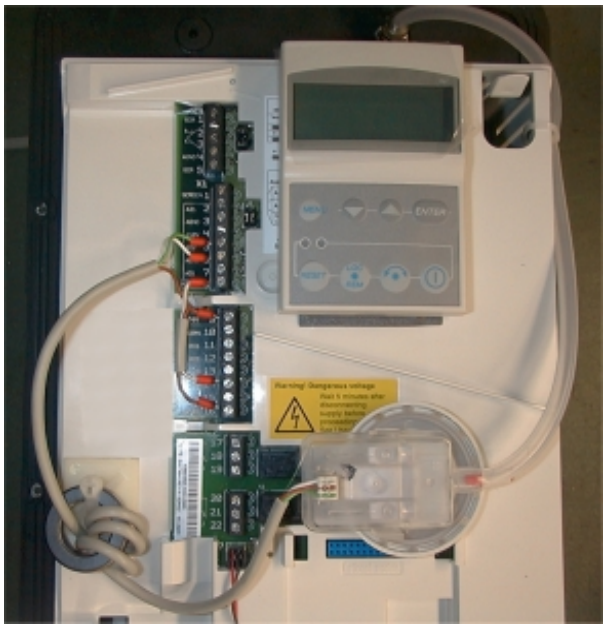


Fig 3 Fan Inverter from 15 kW

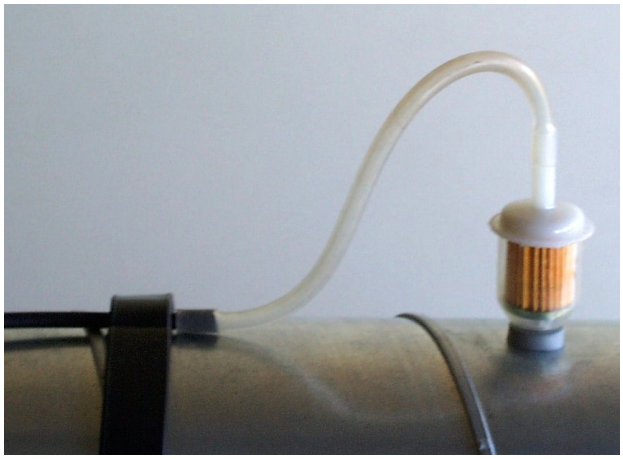


Fig. 4 Pressure tap, hole diam. 16 mm in duct wall. Holder fit 160 – 315 mm duct.

N.B The pressure transducer have to be mount exactly as shown on the pictures. The electrical terminal on the transducer have to be positioned over the two relays to have enough space under the cover.

The flexible hose shall be mounted on the outer, transparent, fitting on the transducer. Do not remove the red plugs. The other end is connected to a fitting in one of the upper holes in the rubber flange. The plastic hose 6/4 mm is then to be connected to the pressure tap in the duct, see fig 4 and 5.

Connect the control cables to terminal X1 according to circuit diagram fig. 6 see also "Control interconnection diagram, general" and "Control interconnection diagram, FILTERMAX " .

The control cable screen shall be connected to X1 - 1 "SCR".

A new warning label in the language of your choice can be attached on the unit cover. fig.1 or inside, instead of the English label, fig 2 and 3.

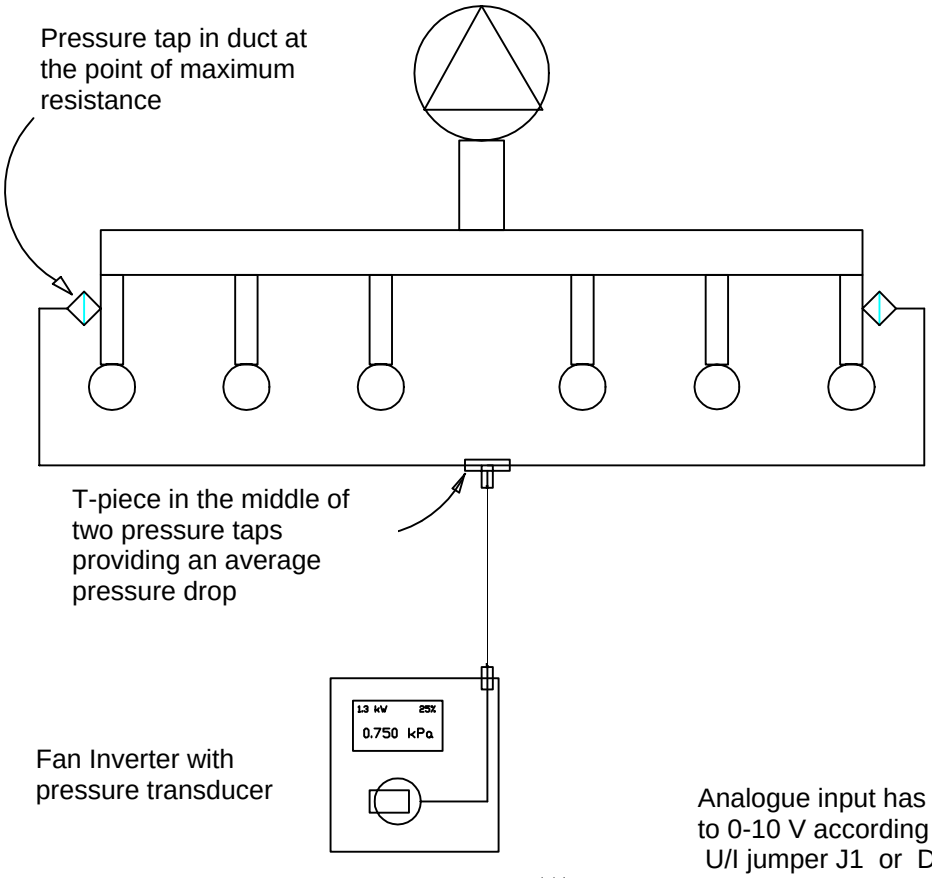


Fig 5 Pressure measurement

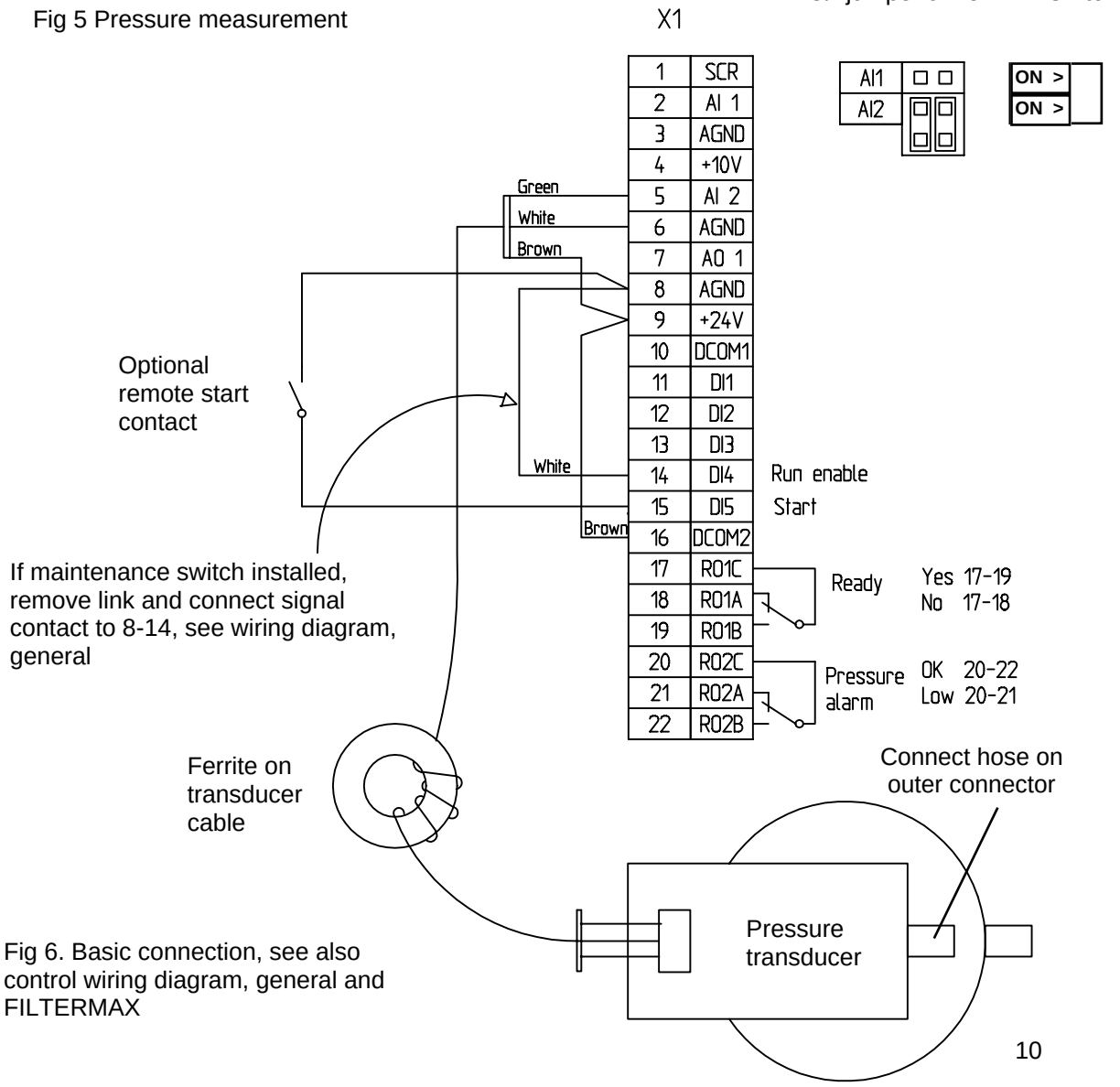


Fig 6. Basic connection, see also control wiring diagram, general and FILTERMAX

THE PRESSURE CONTROLLER

The pressure transducer range is 0 - 3 kPa, the output is 0,5 – 4,5 V and connected to AI2 (analogue input 2) . A pressure tap with filter shall be inserted in the duct at a location were you expect the greatest pressure drop to occur, normally at the most distant extraction unit. If the duct system is branched, you could use pressure taps in the end of the branches and connect them together, with equal length of hose before you connect the pressure signal to the Fan Inverter. In this way you get an "average" pressure value.

The PID controller senses the actual pressure value, represented in the display as kPa and adjusts the speed of the fan in order to keep the pressure in accordance with the reference value. The reference value is set by pressing the up or down arrow keys on the keypad. The reference value is in a "%" of the pressure transducer range, in the upper right of the display. 30% reference value corresponds to 0,30 x 3 kPa = 0,90 kPa. Set the reference to a value that gives you the correct airflow from the extraction points.

PROGRAMMING

Fig 7. Control Panel

Fan Inverter is pre-programmed.
At delivery the basic programming is stored in the Fan Inverter.
A copy is also stored in the Control Panel memory as a backup.
The basic parameters for the actual motor have to be set prior to use.

Get familiar with the ACS-PAN-A Control Panel by reading the ACS-PAN-A part in the Programming chapter in the ABB User's Manual.
For the programming and test run the Fan Inverter have to be in Local mode, LOC. To be able to see all parameters the “FULL MENU” has to be selected. Press the MENU-button and arrow-buttons so you get "FULL/SHORT MENU then press and hold ENTER until you get “*”visible in the display.
Now you move with the arrow-buttons to group 99 START-UP DATA, press ENTER and you get access to the parameters. Please set the motor parameters and language of your choice, see table below.

When changing a parameter press ENTER and you will get a line under the parameter value, change the value with the arrow-buttons and confirm by pressing ENTER again. To exit press the MENU-button.

Note Do not change any other parameters than listed in the table below as this may render the inverter useless. Please contact Nederman direct if this is needed.

Code	Name	Parameter alphanumeric	Please note used values
9901	LANGUAGE	ENGLISH (UK) or your choice	
9905	MOTOR NOM. VOLT	*According to motor plate*	
9906	MOTOR NOM. CURR	*According to motor plate* *	
9907	MOTOR NOM. FREQ.	*According to motor plate*	
9908	MOTOR NOM. SPEED	*According to motor plate*	
9909	MOTOR NOM. POWER	*According to motor plate*	
9910	MOTOR COS PHI	*According to motor plate*	
1003	DIRECTION	FORWARD / REVERSE	
1406	RELAY 2 OFF DELAY	15 s Alarm delay time	
1602	PARAMETER LOCK	LOCKED / OPEN	
1605	LOCAL LOCK	OPEN / LOCKED (only in REM mode)	
3202	SUPERV 1 LIM LOW	25% Alarm level	
3203	SUPERV 1 LIM HI	28% OK level	
4019	SET POINT SEL	EXTERNAL (arrow buttons)/(INTERNAL)	
4020	INTERNAL SETPNT	*According to your system (preset* 40%)	

* When using oversized motor rating, set the value = the maximum current (I_{2NSQ}) for the Fan Inverter: Fan Inverter 7.5 together with NCF 80/25 11 kW 9906 = 15.3 A and Fan Inverter 11 together with NCF 120/25 15 kW 9906 = 23 A FanInverter 15 together with NCF 160/25 18,5 kW 9906 = 30 A.
Note. At acceleration and deceleration a warning for overcurrent and overvoltage may occasionally be visible at the display this is not any fault, we are only using the inverter to its limit

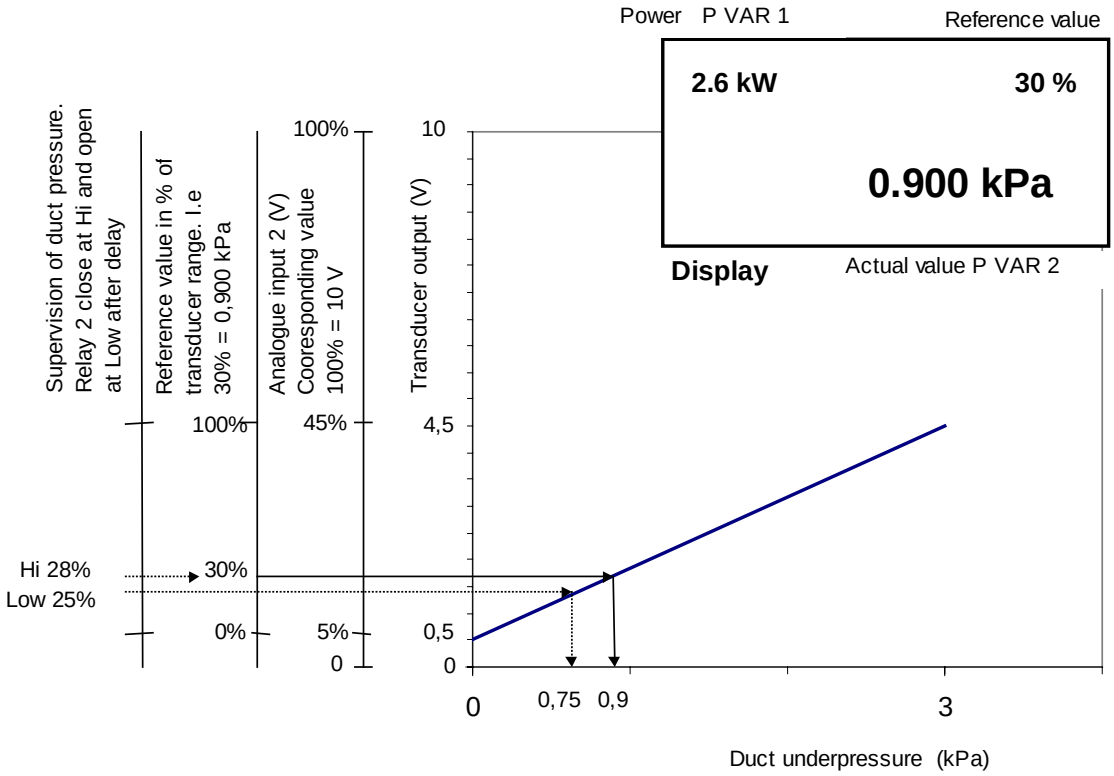
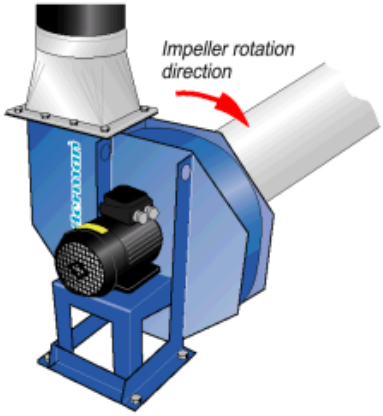


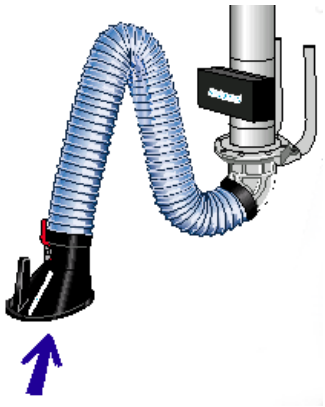
Diagram 3 Pressure signal

STARTING UP



Now it is time to start the fan for the first time.
Set the reference value to 30% by pressing the arrow-button.
In LOC mode start and stop the fan with the 1/0-button to check the fan rotation. To change the direction you can change the parameter 1003, FORWARD or REVERSE.

Change to REM if you are going to us the remote start mode.
Check the reference value again, it may have been changed when changing from LOC to REM.
Start the system with 1/0 button in local mode or by activating the remote start contact, i.e. FILTERMAX start button. If there is any damper between the fan and the pressure tap it have to open.
The fan will now accelerate up to a speed creating a 30% = 0.900 kPa system pressure in the duct at the pressure tapping.



Adjust the reference value up or down by using the arrow-buttons on the panel to achieve the correct extract rate from the hoods etc.

SUPERVISION

It is important to have sufficient airflow in the extraction points. Fan Inverter controls the fan capacity to the actual demand. However the system pressure may not be sufficient i.e. when too many extraction points is open at the same time, the reference value have been decreased or the hose to the pressure tap is broken. Integrated in the Fan Inverter there is a possibility to supervise the system pressure, relay 2 is used for this supervision. The relay is ON when the pressure is OK and can be connected to an external warning system or FILTERMAX control box..

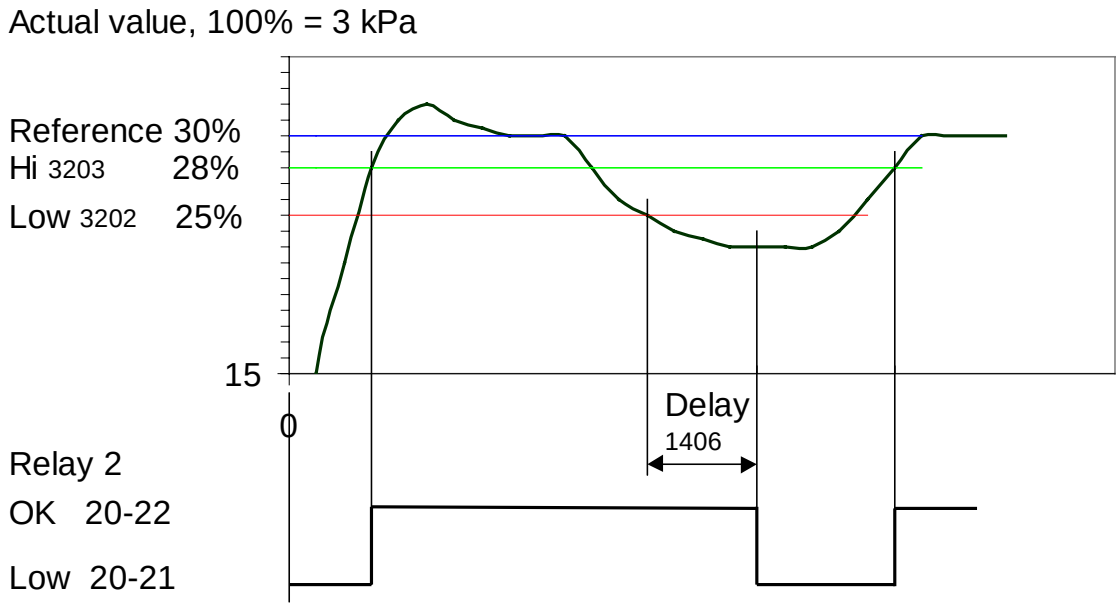


Diagram 4 Supervision.

The parameters Hi and Low are setpoints for the action of the relay and have to be adjusted according to the used reference value, in this example the reference is 30 % - 0,9 kPa. The OK-level “Hi” is somewhat lower 28% - 0,84 kPa. The Alarm level “Low” is set to the lowest acceptable level giving sufficient airflow in the extraction devices.
The relay is de-energised after a delay time, default 15 s.
When connected to FILTERMAX “Low airflow” -input there is an additional 60 s delay before a FILTERMAX Service alarm is activated.

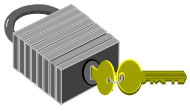
READING OPERATING DATA

When the system is working correctly a reading and noting of operation data (Group 01) is recommended. For this operation the FULL MENU have to be selected “*” must be visible in the display.
With the maximum numbers of extractor points open, according to the dimensioning, read and note the operation data.

The RUN TIME (0114) and the kWh COUNTER (0115) can bet reset, see ABB User's Manual.

Let an electrician measure the mains voltage during operation and note it down.

LOCKING



When completed lock local mode parameter "1605" if only remote is to be used and finally Lock parameters "1602”. To use panel 1/0 button again unlocking has to be made in reverse order.
The reference value can still be changed with the arrow buttons. If the reference value shall not be easily changed the internal reference can be selected before locking, parameter 4019 SET POINT SEL set to INTERNAL and the reference value set in parameter 4020.

ACCESSORIES

Main (Safety/Maintenance) switch 3 pole, max 18,5kW, EMC		14372075
Fuse 6A incl.4th pole (N) to main switch 14372075 for supply 230 V to external equipment (i.e. FILTERMAX),		14371984
Fan Timer		14372077
Voltage separation relay		
	12 V AC	14372148
	24 V AC	14372149
Hose 6/4 mm, 100 m		14372082

SPARE PARTS

Ordering Instructions

When ordering spare parts always indicate the following:

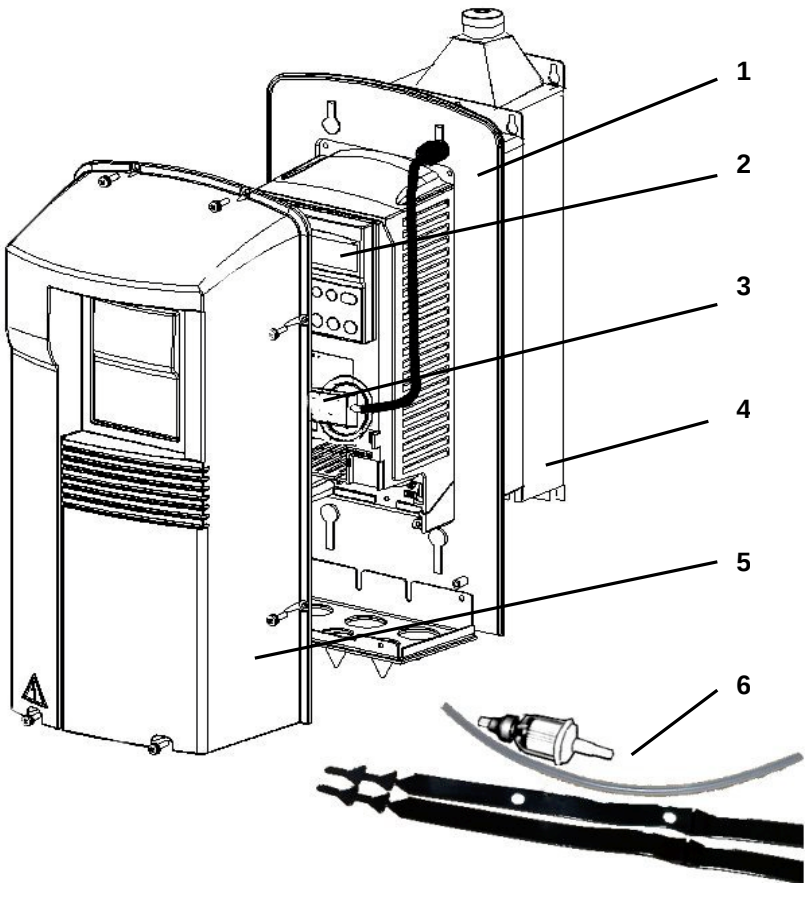
A. Part No. and Control No. (see Nederman Fan Inverter identification plate)

B. The spare part's name and number, (see Spare Parts List)

C. Quantity of parts required.

Spare Parts List

	Name
1	Frequency control, incl. Cover and Control Panel
2	Control panel
3	Pressure transducer kit
4	RFI-filter
5	Cover
6	Pressure tap kit



PARAMETER LIST

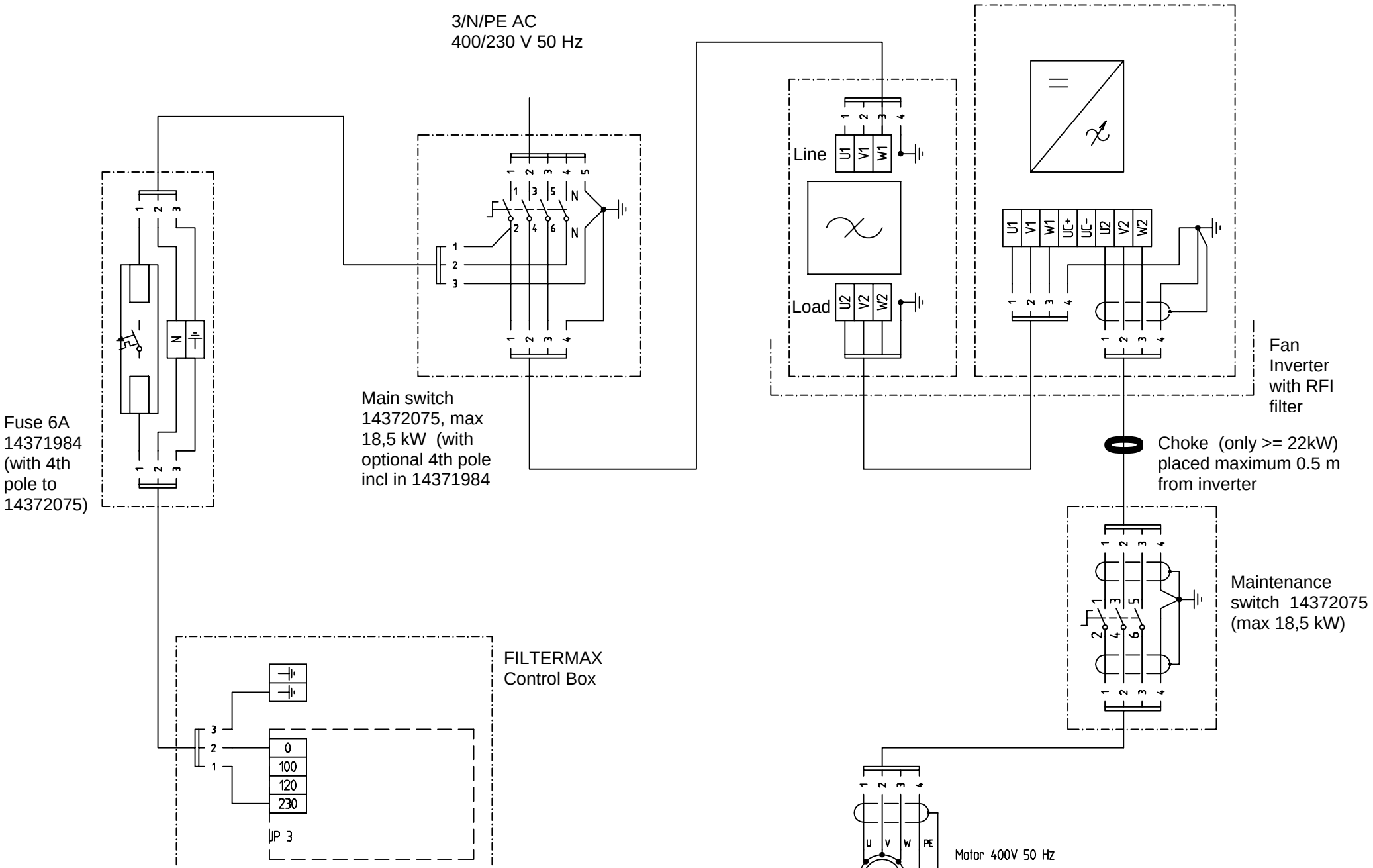
Fan Inverter is pre-programmed. At delivery the basic programming is stored in the Fan Inverter. A copy is also stored in the Control Panel memory as a backup.Additionally is here the complete list of parameters to be checked/changed after the application macro is selected. To be able to see all parameters the "FULL MENU" have to be selected, "*" must be visible in the display.

Code	Name	Parameter alphanumeric	Used values**
9901	Language	ENGLISH (UK) or your choice	
9902	Application makro	PID CTRL	
9905	Motor nom. volt	According to motor plate	
9906	Motor nom. curr	According to motor plate *	
9907	Motor nom. freq.	According to motor plate	
9908	Motor nom. speed	According to motor plate	
9909	Motor nom. power	According to motor plate	
9910	Motor cos phi	According to motor plate	
1003	DIRECTION	FORWARD / REVERSE	
1101	KEYPAD REF SEL	REF2 (%)	
1102	EXT1 / EXT2 SEL	EXT 2	
1106	EXT REF2 SELECT	KEYPAD	
1304	MINIMUM AI 2	5 %	
1305	MAXIMUM AI 2	45 %	
1306	FILTER AI 2	1.0 s	
1401	RELAY OUTPUT 1	READY	
1402	RELAY OUTPUT 2	SUPERV1 OVER	
1406	RELAY 2 OFF DELAY	15 S Alarm delay time	
1602	PARAMETER LOCK	LOCKED / OPEN	
1605	LOCAL LOCK	OPEN / LOCKED (only in REM mode)	
2003	MAX CURRENT	($I2_{NSQmax}$, see user's manual section S)	
2008	MAXIMUM FREQ	50 Hz according to fan	
2101	START FUNCTION	FLY + BOOST	
2102	STOP FUNCTION	COAST	
2103	TORQ BOOST CURR	Max	
2202	ACCELER TIME 1	30 s	
2203	DECELER TIME 1	30 s	
2606	U/F RATIO	SQUARE	
3001	AI < MIN FUNCTION	NOT SEL	
3201	SUPERV 1 PARAM	127 (PID) Actual value)	
3202	SUPERV 1 LIM LO	25% Alarm level	
3203	SUPERV 1 LIM HI	28% OK level	
3401	DISPLAY SEL	PROCESS VAR	
3402	P VAR 1 SEL	106 (Power)	
3403	P VAR 1 MULTIP	1	
3404	P VAR 1 DIVISOR	1	
3405	P VAR 1 SCALING	1	
3406	P VAR 1 UNIT	KW	
3407	P VAR 2 SEL	127 (PID Actual value)	
3408	P VAR 2 MULTIP	300	
3409	P VAR 2 DIVISOR	100	
3410	P VAR 2 SCALING	3	
3411	P VAR 2 UNIT	KPa	
4001	PID GAIN	1.3	
4002	PID INTEG TIME	6s	
4019	SET POINT SEL	EXTERNAL (arrow buttons) / (INTERNAL)	
4020	INTERNAL SETPNT	*According to your system (preset* 40%)	

* When using oversized motor rating, set the value = the maximum current (I_{2NSQ}) for the Fan Inverter: Fan Inverter 7.5 together with NCF 80/25 11 kW 9906 = 15.3 A and Fan Inverter 11 together with NCF 120/25 15 kW 9906 = 23 A. Fan Inverter 15 together with NCF 160/25 18,5 kW 9906 = 30 A (At acceleration and deceleration a warning for over-current and over-voltage may occasionally be visible at the display).

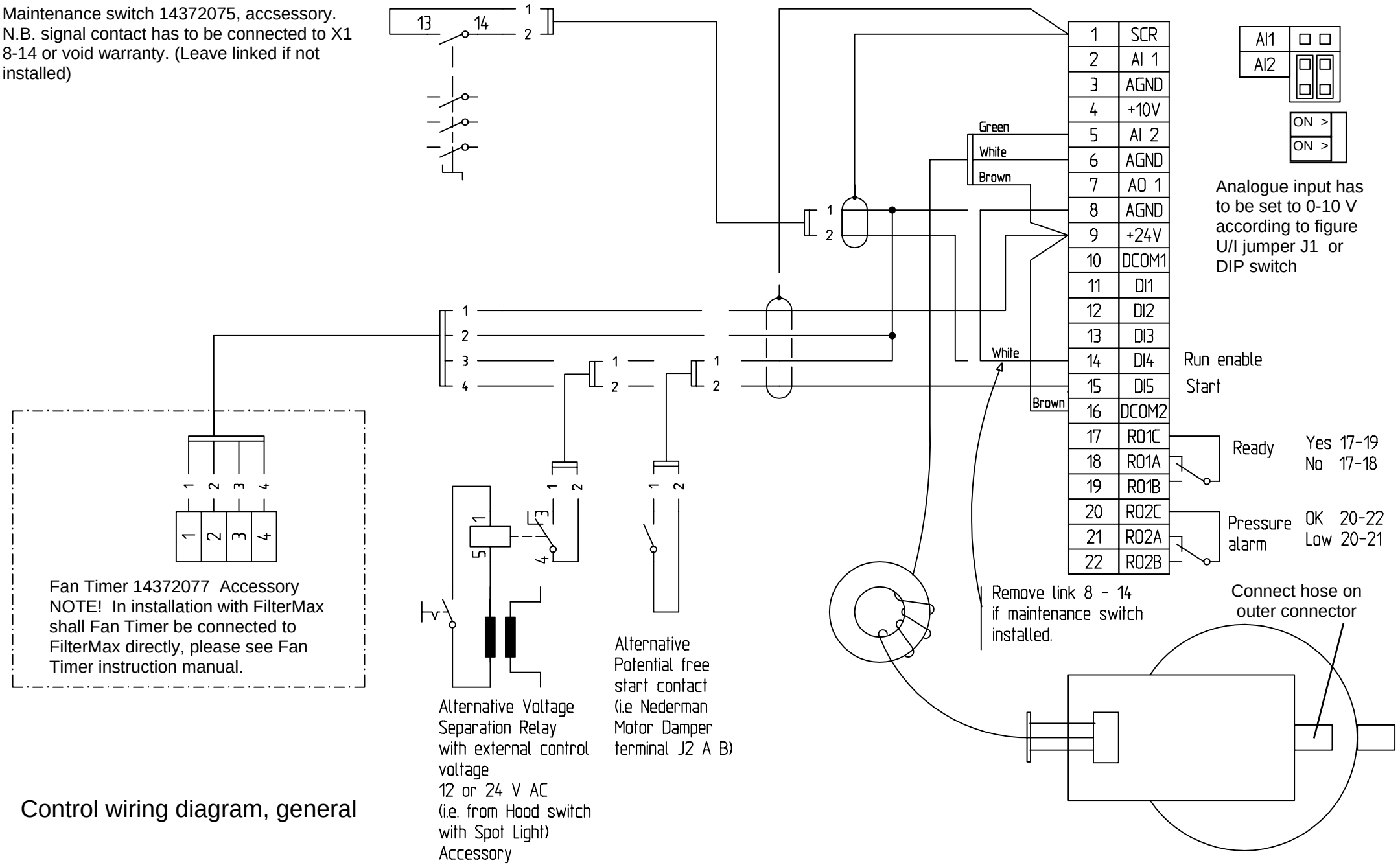
Note. At acceleration and deceleration a warning for overcurrent and overvoltage may occasionally be visible at the display this is not any fault, we are only using the inverter to its limit.

**** Note.** Do not change grey-marked parameters or other parameters not listed in this table. Contact Nederman if changes are necessary. Warranty could be invalidated.



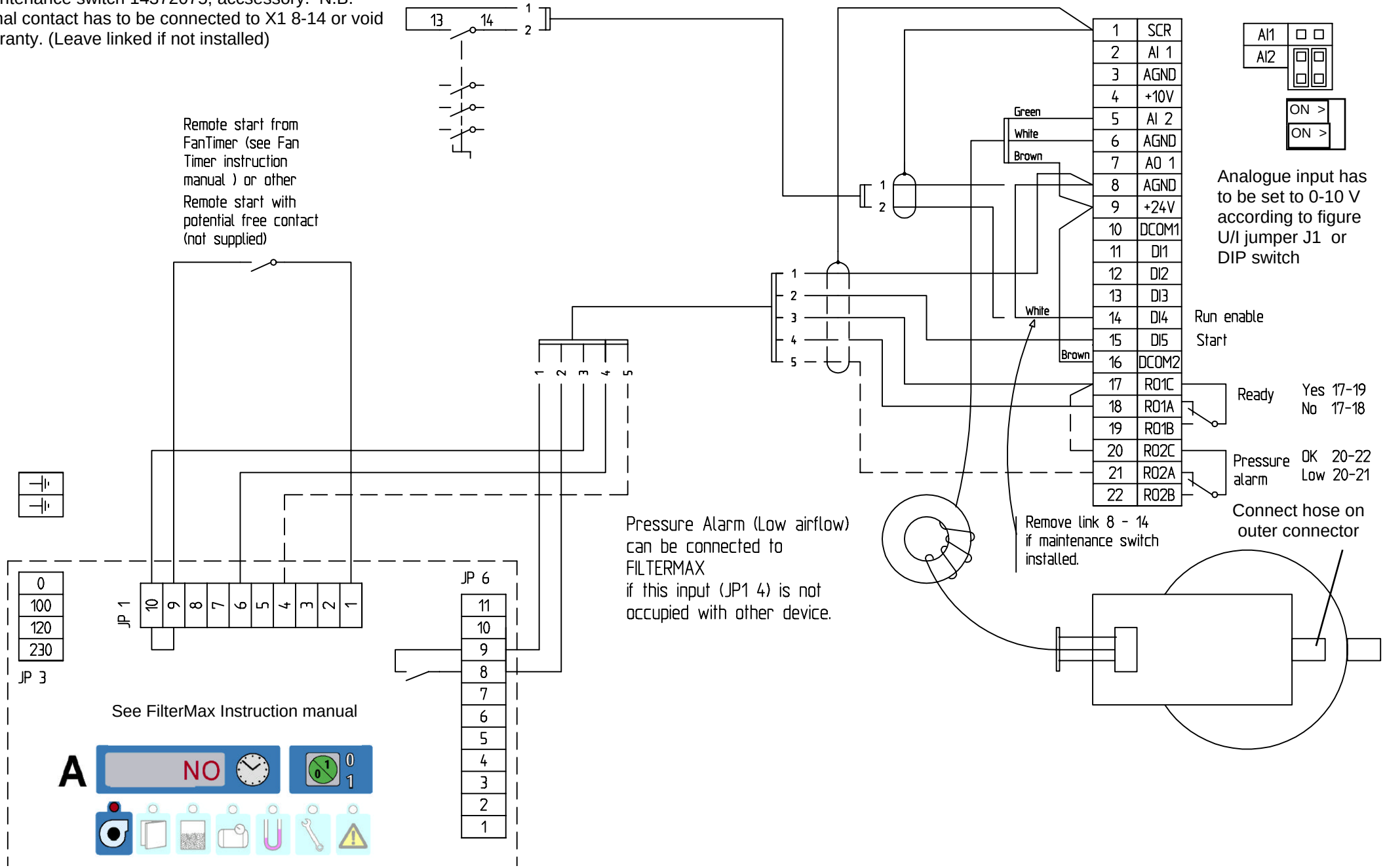
Mains wiring diagram

Maintenance switch 14372075, accsessory.
N.B. signal contact has to be connected to X1 8-14 or void warranty. (Leave linked if not installed)



Control wiring diagram, general

Maintenance switch 14372075, accsessory. N.B. signal contact has to be connected to X1 8-14 or void warranty. (Leave linked if not installed)



Control wiring diagram, FILTERMAX

Nederman®

Improving your workspace

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