



QUEENSLAND URBAN UTILITIES

Caswell St, East Brisbane Biological Odour Control Facility



Project Number 1676

Operations & Maintenance Manual

O&M Manual-1676-220210



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Responsible Person	Bashar Abuusba	Date	April 2010

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1. Introduction

1.1 Operation Principle of Biofilters

A biofilter is simply a layer of organic material, typically a mixture of nutrients, calcium carbonate and rice hulls that supports a population of bacteria. Odorous air is forced through this material and is converted by microbes to carbon dioxide and water.

Micro-organisms (bacteria, fungi and yeast) play an important role in the cycle of nature. They perform the most elementary steps in this cycle by converting and degrading the dead remains of plants and animals. These remains generally consist of a broad spectrum of very complex compounds. Since micro-organisms can degrade all these compounds then they must possess the ability to adapt.

Biological air purification uses the special abilities of micro-organisms to degrade a wide range of components. The most important step is finding the micro-organism most suitable to degrade the unwanted components in the gas flow. Micro-organisms therefore determine the possible applications for the biofilter.

The micro-organisms selected for the application are cultured in fermenters at CleanTeq to the required population levels, and are then inoculated onto the filter media during production.

This means that there will be a number of different types of micro-organisms in the filter media upon installation. The dominant types of micro-organisms in the system will be the species that best utilise the odorous compound as a food source.

As the odorous compounds pass through the filter materials they are absorbed into the water layer. It's in this water layer (known as Biolayer or Biofilm) where micro-organisms use the odorous compounds as part of their food source for energy production and reproduction.

The compounds are taken up by the microorganisms, biologically degraded and the by-products excreted back into the water layer.

Carbon based compounds are generally oxidised to carbon dioxide and water; in the presence of a halogen, sulphur or nitrogen compound. A mineral salt or elemental product is also produced. Such reactions may include:

Thiobacillus species $\text{H}_2\text{S} \rightarrow \text{SO}_4^{-2} + \text{Energy} + \text{Acid}$

Nitromonas species $\text{NH}_3 \rightarrow \text{NO}_2^- + \text{Energy} + \text{Acid}$

The mineral salts & acidic by-products are neutralised by alkaline components within the filter media. CleanTeq filter media is specifically designed with a high buffering capacity to ensure that the filter has a long serving life. When this buffering capacity component has been fully utilised, media recharging or replacement is required.



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During operation of biofiltration system, the odorous airstream may fluctuate in composition and strength. The micro-organisms will gradually adapt to these variations overtime.

1.2 Principle Operation of Activated Carbon Tank

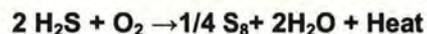
An activated carbon tank is acting as a polishing stage to remove the reminder of hydrogen sulphide and volatile organic compounds (VOC's) that passed through the biofiltration stage.

Activated Carbon is a black, solid material resembling charcoal that has been treated with oxygen to open millions of small pores between carbon atoms. It is an extremely porous material with a large internal surface area which accounts for its power to hold impurities, contaminants and other pollutants by a process known as adsorption.

Numerous types of activated carbon are available, including pelletised, powdered, impregnated made out of several different materials such as coal, coconut shell and wood.

The adsorption process is simply allowing the positively charged active carbon to attract the negatively charged impurities. The gas molecules of chemicals, VOC's and other impurities get stuck in the numerous tiny pores on the surface area of the activated carbon present in the filter. The amount of impurities attracted by the filter would be in proportion with the amount of carbon and its thickness.

A dry blend of H₂S and Oxygen does not react at ambient temperature, but only above 200 C. However, in the presence of activated carbon, H₂S reacts with oxygen at low temperature to produce sulphur and water :



The sulphur produced is adsorbed on the internal surface of the activated carbon and the water is desorbed from the catalyst surface.

To boost the activity of oxidation a promoter (KI) is used. Potassium Iodide (KI) impregnation of activated carbon not only increases the reaction velocity but also inhibits the formation of sulphuric acid by unwanted side-reactions.

Clean TeQ is using what's called CleanCarb 4-KI, a 4mm diameter cylindrical pelletised virgin activated carbon impregnated with 2% Potassium Iodine (KI) and made especially for vapour applications.

The factors that may have an effect on the adsorption capacity of the activated carbon are temperature, relative humidity and residence time. Optimum parameters must be chosen to extend the life of activated carbon.

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1.3 Technical Description

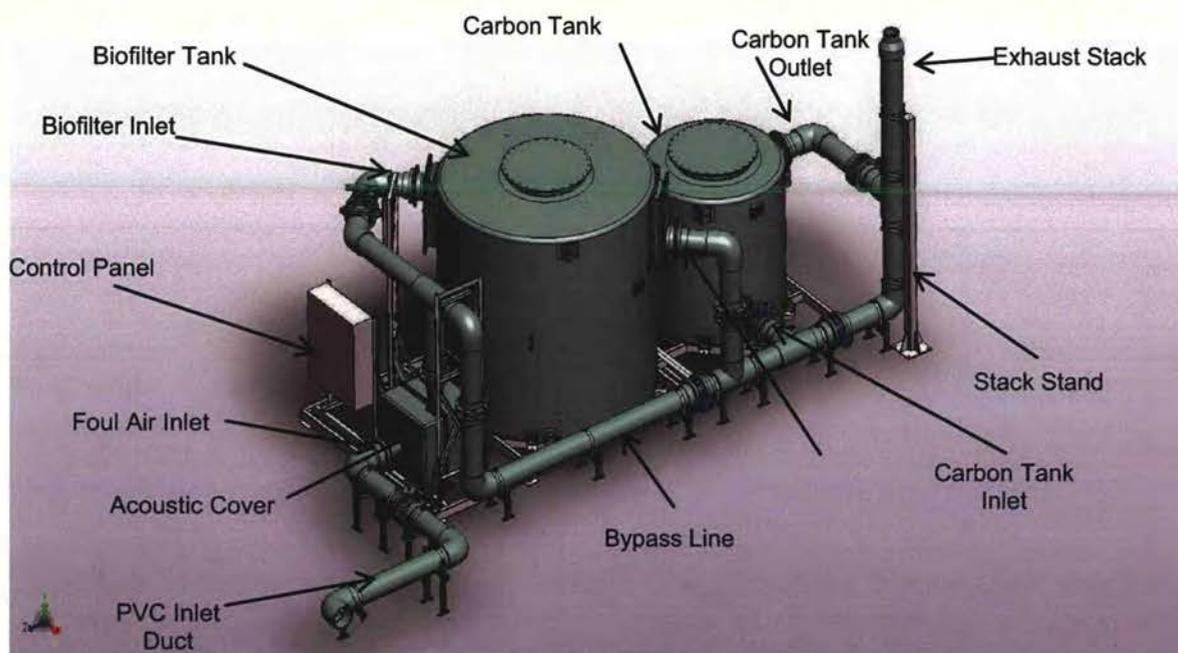


Figure (1)

The Odour Control System consists of:

- PVC inlet duct of caswell pump station to the foul air inlet
- Duty fan and acoustic cover.
- Bybass line duct.
- Biofilter fiberglass tank.
- Carbon fiberglass tank.
- Exhaust stack.
- Control panel.
- Gas analysers on inlet and outlet ducts.
- Service platform.
- Biofilter media.



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1.4 Functional Description

The odour control system is very simple to operate and designed to be an unmanned facility. However, the plant should be inspected from time to time for any abnormal operation issues.

The fan extracts the air from the wet well and pushes it through the filter media and exits from the tank side. It enters the carbon tank from the bottom and exits from tanks side flowing into the stack.

Most of the hydrogen sulphide will be treated in the Biofilter, while most of the VOC's(volatile organic compounds) are treated in the carbon tank.

The air flow for the facility is designed to be 1000 m³/hr. If the flow drops below 400 m³/hr for more than 40 seconds, the system will shutdown for 6 hrs before it starts automatically again. If the facility shuts down for 3 consecutive times, the system will latch out and will not reset unless an operator attends to resolve the issue.

The set point of the air flow can be changed if needed by adjusting a small potentiometer on the air flow switch. The technical data sheet is provided in the appendix.

The media depends on being kept wet to perform well. Water is sprayed frequently through nozzles mounted above the media surface. The spraying amount is controlled via a PLC program that sends a signal to a solenoid valve to open and allow water to go through. A timer is installed in the Local Control Panel to adjust how often and how much water will be sprayed.

If the water flow rate drops below 7.8 L/min while spraying is being carried out, the system will shut down for 6 hours, before starting automatically again. If the facility shuts down for 3 consecutive times, the system will latch out and an operator must attend to resolve the issue.

It's necessary to mention that the system will not shut down for a sudden drop in air flow rate. The drop must continue for 40 seconds before air flow switch sends any signal to PLC.

Any fault that occurs during the operation will shut the system down and a red light will be shown on the LCP. An operator needs to resolve the issue and reset the system to get it running again.

A Variable Frequency Drive (VFD) is installed inside the LCP to control the speed of the fan. It has a display screen that can show power consumption, running hours, frequency and fan speed. Only a trained operator is permitted to change the settings, in order to optimise the system.



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1.5 Brief Description Of Major Components

1.5.1 Inlet Ductwork

The inlet duct carries foul air from the wet well inside the pumping station to a duty fan placed under the acoustic cover.

The system has been designed such that the total air volume drawn from the wet well is approx. 1000 m³/hr. The foul air ductwork is constructed from PVC material. The ductworks are supported by saddles or pipe clamps to prevent vibration during normal operation.



Figure 2

1.5.2 Fan Inlet Flexible Connection

The fans inlet transitions are made from X-5 Fabric and connect the inlet duct to the fans. The X-5 Fabric is an impregnated rubber and the expansion joint is made to suit. See appendices for data sheet.

Fan Inlet Flexible Connection

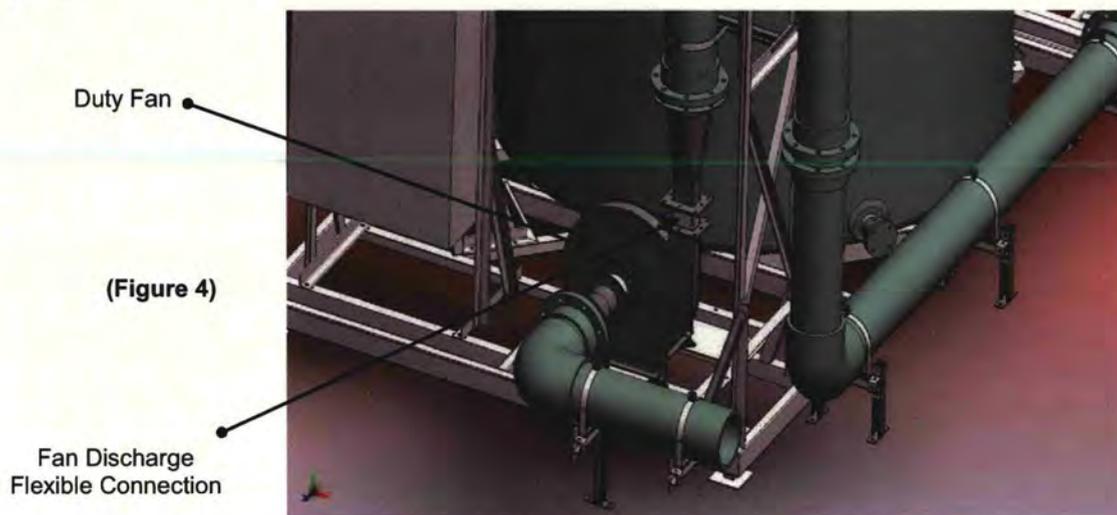


(Figure 3)

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1.5.3 Fan

The fan is designed to draw foul air from the pumping station wet well and supply the air at a constant flow into the Biofilter. The fan is manufactured from stainless steel (316). The centrifugal fan has been specifically selected to operate with minimal maintenance. It is recommended that the fan operate continuously to achieve the optimum level of reliability for both the fan and Biofilter System.



1.5.4 Fan Discharge Flexible Connection

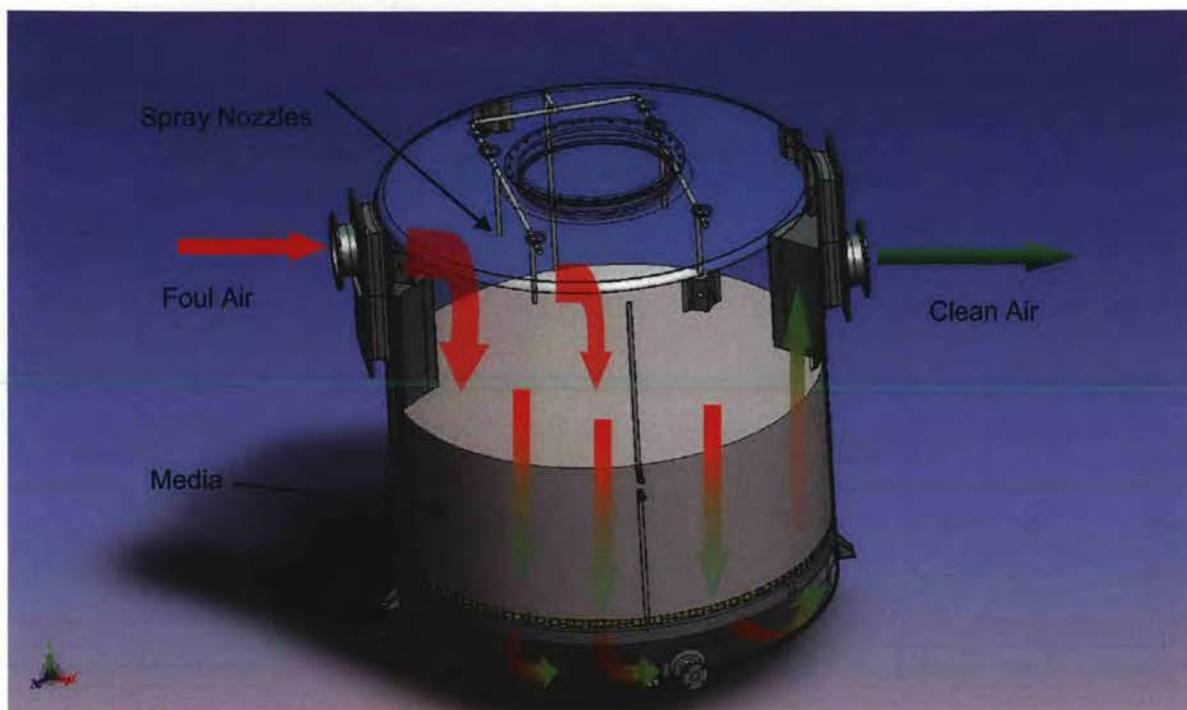
The fan discharge transition is made from X-5 Fabric and connects the fan to the outlet duct. The X-5 Fabric is an impregnated rubber and the expansion joint is made to suit (Figure 4). See Appendices for data sheet.

1.5.5 BioFilter Housing

The Biofilter consists of an enclosed container filled with 6.4 m³ of Biofilter Media (figure 5). The air enters into the top of the BioFilter housing and then passes through the Biofilter media bed. Contaminants present in the air are adsorbed into the aqueous phase of the Biofilter Media. The contaminants in turn are oxidised rendering them odourless.

The base of the BTF consists of storage sump of approximately 200mm depth of liquor. The volume of the liquid in this sump is approx 800 L .

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BioFilter Housing (Figure 5)

1.5.6 Activated Carbon Housing

The treated air is discharged from the BioFilter housing through a 200mm PVC duct into an activated carbon tank (Figure 6) where it passes through a carbon bed to treat any remaining H₂S and VOC's.

The tank is made of a fibreglass material and contains 316 stainless steel mesh located on top of the base grating to prevent the small particulates from falling through. The mesh sheets are manufactured to handle the corrosive gases present in the system.

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(Figure 6)

1.5.7 Activated Carbon Packing

The activated carbon unit contains 0.91 m³ of Pelletised Activated Carbon. The carbon is Potassium Iodide (KI) impregnated. The KI acts as a catalyst to convert the sulphides adsorbed on the surface to sulphur, increasing the available loading capacity of the carbon. The pelletised Activated Carbon is used to minimise pressure drop across the system.

1.5.8 Moisture Control Components

In order to maintain the moisture level of the bed, each BioFilter has a system of moisture control components as following:

- **Spraying Nozzles:** The system has 4 spraying nozzles across the top of the media to allow complete coverage of the bed. The nozzles are made of PVC corrosion resistant material and have an orifice size of 2.77mm to avoid clogging by particles that may exist in the system.

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- **Solenoid Valve:** The valve is energised when it receives a signal from the PLC to open and allow the water to be sprayed over the media for a specific time. The spraying time can be adjusted via an external timer placed inside the control panel.
- **Water Flow Switch:** The aim of this flow switch is to send an alarm if the water flow is dropping under a pre-set point of 7.8 L/min. The system will shut down and a personnel must investigate the cause of the flow rate drop, fix it and reset the system again.
- **Pressure Regulating Valve (PRV):** Water line pressure is to be maintained using a PRV valve that can be adjusted to choose the suitable pressure for the spraying components.
- **Rotameter :** Gives an indication of the water flow rate and help recognising whether nozzles are blocked for any reason.
- **Strainer:** All particles in the water stream must be filtered by strainer to avoid nozzles blockage that may lead to media drying and bacteria death. The strainer must be checked frequently to ensure a smooth flow through the line.

All components are indicated as below in (Figure 7) :



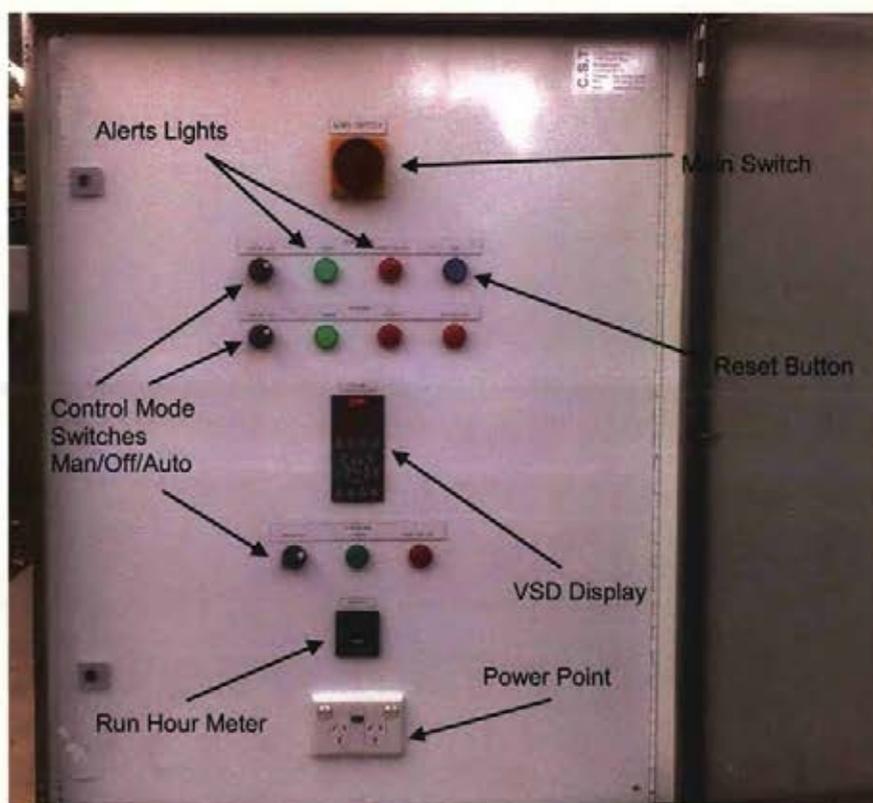
(Figure 7)

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1.5.9 Electrical Control Panel:

The odour control system is controlled by Local Control Panel (LCP) that has PLC instruments to operate the Biofilter as per function description. The LCP has the following items as seen in (Figure 8):

- **Main Switch:** To switch power off or on from Biofilter.
- **Manual/Off/Auto Switches :** To switch between Operation modes
- **Alerts lights:** To give indications whether equipment and instruments are running or not.
- **VSD Display:** To give the option of adjusting the fan speed.
- **Reset Button:** To reset the control system and start the biofilter operation.
- **Run Hour Meter:** To count running hours of the control system (Not Fan).
- **Power Points :** To be used by any instrument or tool that needs power.



(Figure 8)

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1.5.10 Gas Analyzers

The Biofilter has the option of monitoring the composition of the inlet and outlet air stream to ensure that odour treatment unit is performing as per expected. Gas analyzers (**Figure 9**) are installed on the inlet and outlet of the biofilter to sense the H₂S composition in ppm .(Part Per Million) and show the readings on the display. The analysers have two ranges of detection. The inlet gas analyser senses the range of (0-500 ppm) while the outlet analyser has a range of (0-50 ppm). A small particles filter and air flow regulator is mounted in the gas analyzer cabinet to clean and regulate air flow at 0.5 L/min.



(Figure 9)



(Figure 10)



(Figure 11)

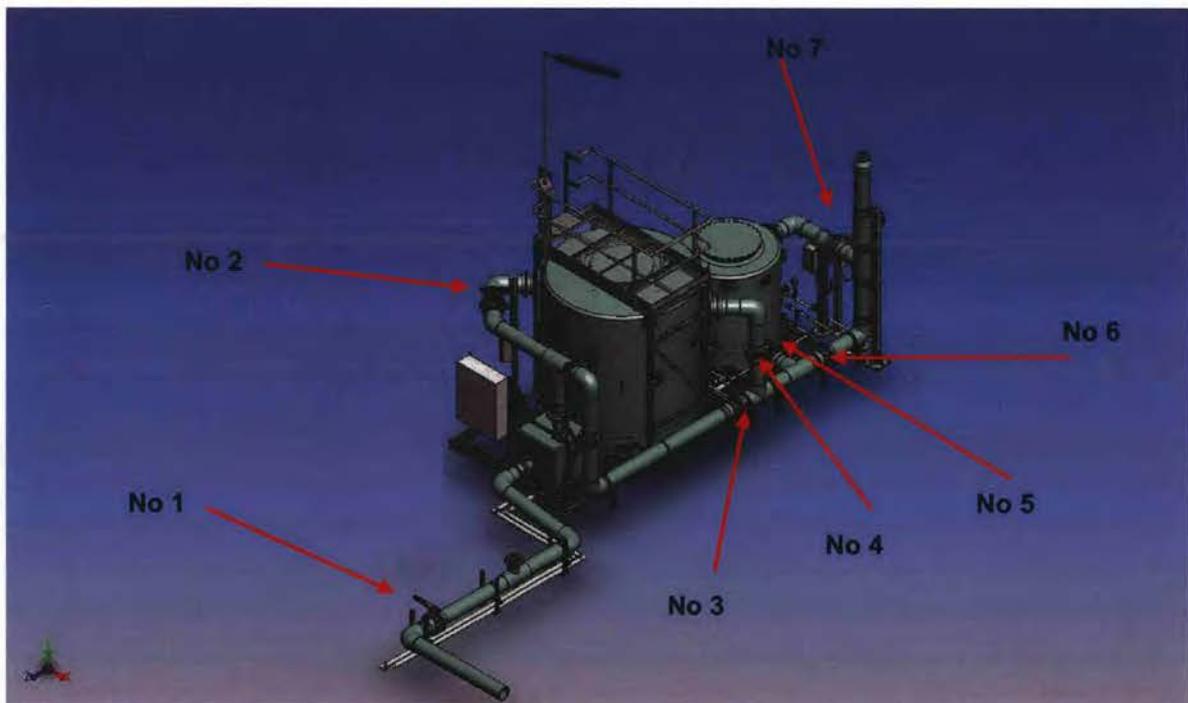
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2. Biofilter Operational Procedure

2.1 Start Up Procedure

To start the biofilter, the following points should be followed with referring to **Figure 12** :

- Ensure the inlet butterfly valve **No 1** is open.
- Ensure bypass butterfly valve **No 3** is closed
- Ensure Butterfly **No 6** is closed.
- Ensure Valves **No 2, 4, 5, 7** are fully open.
- Ensure all switch modes are switched to the OFF position.
- Switch on the main switch on the control cabinet and wait 30s.
- The VSD display will power up. Ensure the Auto indication on the display is ON.
- Turn all control mode switches to Auto.
- The fan will start running and VFD display shows the fan speed and power consumption. THE SYSTEM IS NOW RUNNING.

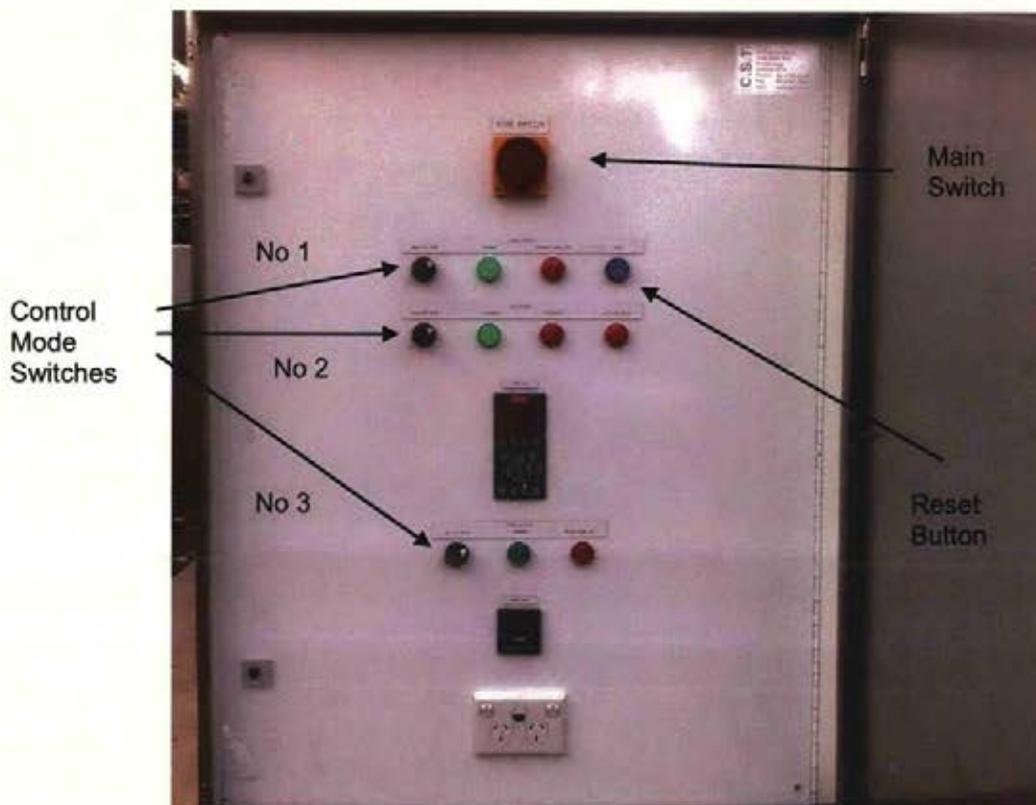


(Figure 12)

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2.2 Shutdown Procedure

- Turn the control mode switches **1, 2 & 3** from **Auto** to **OFF** position.
- Switch off the main switch in the Electrical Control Panel, see **(Figure 13)**.
- Close Inlet Valve **No 1**, see **(Figure 12)**.



(Figure 13)



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2.3 Emergency Shut Down

To stop the plant in an emergency, hit the emergency stop located on the control panel. Reset the stop after it is safe to do so to allow restart of the plant as per normal startup procedure.

2.4 Resetting The System

After resolving any fault in the odor control facility, the system should be reset before starting in **Auto** mode. The system can be reset by pushing the reset button located in the control panel. If the system fails to start, check if the emergency stop is released. To release the emergency stop, push the stop, twist it and pull it back.

2.5 Operational Modes

The plant can be operated using three operational modes shown on the LCP as following:

- **Auto Mode:** The PLC will take control of the plant and run it as programmed.
- **Off Mode :** The plant is not running
- **Manual Mode:** Major components can be operated independently.



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2.6 PLC Program

The operation of the odour treatment facility is controlled via a PLC software that runs the instruments and equipment in accordance to a written program. This program was written to ensure a proper operation of the system as follows:

- If fan starts, 40 seconds will elapse before air flow switch starts sensing the flow.
- If air flow rate drops below set point (400 m³/hr) for 40 seconds, an alarm is generated and the system shuts down before it starts again automatically after 6 hours.
- If the system shuts down for 3 consecutive times in 18 hours, the system shuts down and an operator should investigate the issue.
- If water flow rate is less than 7.8 L/Min for 5 seconds, an alarm is generated and the system shuts down.
- If the fan is overloaded (> 6 Amp), the system will shut down.
- An external timer is controlling the solenoid valve that allows spraying according to the time that has been set on the timer.
- A second external timer can be used to set up a different spraying time.
- If the second timer starts spraying while the first timer still on, the first timer will be overridden and second timer controls the spraying.
- If the solenoid valve is closed and water flow switch still open for a period of 10 min, the system will shut down. An operator should investigate the issue as the solenoid valve might be faulty.
- If water level switch is showing low level, the whole system will shut down.
- During acclimatisation period (2-3 weeks), a recirculation pump is running 24 hrs except when the solenoid valve is opening. The pump stops when spraying starts.
- Once spraying is off, a delay time of 3 min applies before starting the pump again.
- After 2-3 weeks of recirculation, the pump is removed and the internal pump switch is turned into manual instead of auto position.
- The recirculation pump is not applicable for Caswell or Cowper st units because of no need to use any pump in the application. However, if a decision is made to convert Caswell or Cowper st units to biotrickling filters, the PLC program is capable of controlling the operation without any need of re-programming.



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2.7 Operational Parameters

The Typical operational parameters are listed below in the table as following :

	Unit	Design	Actual	Comments
Air Flow Rate	M ³ /hr	1000	980	
Inlet Humidity	%	50-90	50-90	
Inlet Temp.	C°	25	25	
Inlet H2S	PPM	2-20	2-20	
Fan Speed RPM	RPM	2550	3000	
Power Consumption	KW	1.3	1.9	
Frequency	Hz	42	54	
Media Volume	M ³	6.2	6.2	
Pressure Across Media	Pa	365	310	
Pressure Across Activated Carbon	Pa	62	90	
Removal Efficiency	%	99.99	98-100	
Elimination Capcity	g/m ³ .hr	4.9	4.9	
Spraying Frequency	-	1min/3hrs	1min/3 hrs	
Spraying Amount	L/hr	5	5	



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3. Maintenance

The following diagram indicates the maintenance activities required. The column "Item No" gives the paragraph number in which more information can be found. The columns indicate the intervals at which the activities should be carried out. The shortest interval in this scheme is three months. This does not mean, however that no activities are required in between. Historical and analytical purposes alarms and faults are to be registered in the site log book and dealt with adequately.

Action	Item No	3 Months	6 Months	Yearly
Biofilter & Carbon Housing	3.1			X
Biofilter Media	3.2			X
Activated carbon Media	3.3			X
Spraying Nozzles	3.4		X	
Water Flow Switch	3.5		X	
Rotameter	3.6	X		
Solenoid valve	3.7		X	
Pressure Regulating Valve	3.8			X
Fan	3.9	X		
Differential Pressure gauges	3.10	X		
Gas Analyzers	3.11	X		
Air Flow Switch	3.12		X	
Moisture traps (Filters)	3.13	X		
Drainage Lines	3.14		X	
Local Control Panel	3.15	X		
Skids & stands	3.16		X	
Ventilation damper	3.17		X	

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3.1 Biofilter & Carbon Housing

The structure of the Biofilter and Carbon tank housing is made from fiberglass that should be washed with a neutral detergent once a year. The FRP material is Isophthalic polyester resin and "C" glass fiber reinforcement. The gel coat is pigmented and contains filler for UV stabilization and protection. All the fibreglass equipment is manufactured to AS 2634-1983 *Chemical Plant Equipment* made from glass-fiber reinforced plastics (GRP) based on the thermosetting resins. Otherwise no other maintenance is required.

3.2 Biofilter Media

Biofilter media is a mixture of rice hulls, calcium carbonate and nutrients that are necessary for bacteria growth over the expected life of the biofilter. Rice hulls provides a physical support for the bacteria to live on while calcium carbonate provides a buffer capacity to neutralize the media as bacteria tends to generate sulfuric acid as a by-product. When the calcium carbonate is depleted, the media must be replaced. The media also provides the bacteria with the required elements for growth bio-activity such as *Nitrogen* and *Phosphate*. These elements are added in a ratio that is enough for the bacteria to serve over the expected biofilter life.

The biofilter is designed to have a 3 years bed life based on the average H₂S sulfide composition in the air stream. The life expectancy could be less or more, however the media should be inspected every year by Cleanteq personnel to make an assessment of the media condition.

A quick sign of a good media condition is to measure the pH of the liquid in the sump. If it's found to be between 7.5 and 6.5 then media is good. If pH is lower, then the media is starting to lose its treatment ability and media replacement must be considered.

3.3 Activated carbon

The activated carbon pellets should be checked on a yearly basis. The service life is 3 years, however the carbon can be spent if the incoming H₂S composition is higher than it's designed for. A gas detector can be placed in front of the carbon tank sampling points and see if any H₂S is detected. If the lower sampling point is detecting H₂S, the operator should test the higher sampling point. If both are detecting H₂S, then at least 75% of carbon is consumed and a replacement is to be considered.

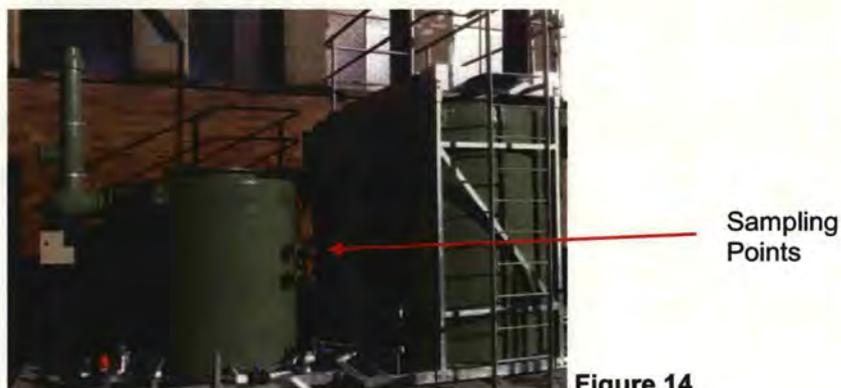


Figure 14



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3.4 Spraying Nozzles

The spray nozzles used in the filter moistening system have an open construction which will generally minimise the chances of clogging. However, the sprays may become clogged if not serviced. Depending on the hardness and particulates in the water, it is advisable to remove and clean the spray nozzles every 12 months.

3.5 Water Flow Switch

The water flow switch requires no periodic maintenance as long as water is filtered from debris and particulates. A water strainer is installed at the water supply line to filter water from contaminants. However, it's advised that switch is checked every 6 months to eliminate any chance of reduced water supply.

3.6 Rotameter

The rotameter gives a visual indication of the water flow rate. Any drop from the design or expected rate is a sign of clogging in the spray nozzles or the piping system. The rotameter is to be dismantled on a 3 monthly basis to ensure no particles or debris is blocking the way.

3.7 Solenoid Valve

A solenoid valve is installed in the main water supply line to control the water flow. The operation of the solenoid is critical to the proper operation of the BioFilter. It is recommended to have a spare solenoid valve on hand if a fault should occur. The solenoid valve has a feature of slow acting (or slow closing) which means it closes slowly so that it reduces hammering problems when the water is shut off suddenly. However, anti-hammer arrestor is installed on the main water supply inlet to help in eliminating hammering. The solenoid valve should be manually operated and checked at a six monthly basis.

3.8 Pressure Reducing Valve

A pressure reducing valve is installed to control the pressure water line to the required set value. The pressure can be reduced or increased manually to ensure the proper spraying rate into the media. Any change in the water supply pressure may affect the spraying flow rate causing oversaturation or dryness of the media. Using the PRV, the pressure can be adjusted to compensate for the water supply change. No maintenance is required for the valve; however a yearly check would be an appropriate procedure to follow.

3.9 Fan

The fan is direct drive, and is controlled by Variable Frequency Drive (VFD). The inlet air to the fans can be contaminated with grease and particulates. Under severe conditions, these contaminants may adhere to the impeller and fan casing with a possibility of reducing performance and causing a reduced life. It is recommended that the inspection cover on the fan casing be removed every six months to inspect and clean the assembly if required without removing the inlet duct. All safety measures are to be taken into account before opening the inspection cover.



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3.10 Differential Pressure Indicators

The differential pressure gauge uses connecting tubes to sense changes in pressure across the media. The tubes may collect condensate over time resulting in incorrect readings. To avoid such problems, a condensate trap or air filter is installed inline with the high pressure tube to eliminate any condensate gathered over a time. However, at 3 -month intervals or when readings are doubtful, remove the tube and condensate trap from the duct end making sure that no fluid flows into the sensing head. Clean and dry the tubing.

If the differential pressure gauge is faulty, please return it to the supplier for repairs.

3.11 Gas Analyzers

There are 2 gas analysers installed on the inlet and outlet of the air stream. The analyser has an internal pump that sucks the required air sample and is sensed by a sensor inside the analyser. The flow is regulated via a flow regulator as shown in the Figure (11) before it's analysed by the gas analyser. The optimum flow rate is 0.3-0.5 L/min) .

It is recommended that all tubes and connections to the gas analyser are checked every 3 months. However, the analyser should be sent for calibration every 6 months.

3.12 Air Flow Switch

The flow switch requires no periodic maintenance except to clean off any deposits or scaling from the sensor tip. Clean the sensor tip with a soft bristle brush and mild detergent every 6 months.

3.13 Moisture Traps (Filters)

The object of these filters is to catch any condensate collected in the tubes before air goes into the differential pressure gauges. Water droplets and high humidity can contribute to false readings and damage the instrument. These filters have self-drainage facilities that allow water to drain if the filter is full of water.

However, inside the filter there is a small white mesh or screen that can be blocked over time and must be check on a 3 monthly basis.

3.14 Drainage Lines

Drainage lines can be blocked by the falling small media particulates if not checked frequently. An operator can disconnect the drainage line at the drainage valve and see whether the line is free of debris or sludge. All safety measures are to be taken into account before disconnecting the line. The line should be checked every 6 months.

3.15 Local Control Panel (LCP)

The local control panel is made from corrosion resistant 316 stainless steel. The front door of the LCP is hinged, lockable and sealed to prevent water leakage to the inside space. However, the cabinet should be checked on a 3 monthly basis for electrical malfunction, water leakage and corroded parts. An electrical maintenance should be carried out every 12 months.

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3.16 Skids & Stands

A general check must be carried out on the skids and stands for signs of corrosion or defects. Although the skids and stands are made of hot dipped galvanized steel, corrosion may occur if skids are exposed to accidentally scratches. An operator is advised to check the general condition of the skids and stands every 6 months

3.17 Ventilation Damper

The ventilation damper is installed on top of the building chimney to prevent atmospheric air being drawn into the wet well by the biofilter extraction fan and acting as a dilution factor for the hydrogen sulphide in the biofilter inlet stream. The ventilation damper louvers open at pressure difference of around 50 Pa.

If an operator wants to carry out cleaning and maintenance duties in the wet well, he should open and secure the three wet well doors and run the ventilation fan(not part of odour system) that will draw air from the wet well out through the ventilation damper. The biofilter may continue to run during the wet well maintenance.

The damper is made of 316 stainless steel and is mounted on the chimney by fixing the damper flanges to the chimney top surface. A gasket is placed between the damper and chimney to prevent any leakage. Please see the picture below.



Picture 15



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4. Troubleshooting

Problem	Possible Cause	Action
1 Pressure across Biofilter is greater than 550 Pa	Filter beds are excessively wet	Check moisture, if excessive investigate solenoid valve, operation, or pipe break
	Bed has been blocked with aerosol or particulate.	Check bed visually
	Excessive airflow.	Adjust damper.
	Bottom tank below stack is full of water	Check drainage valve. Keep it open
	Bed has degraded	Replace bed.
2 Pressure across Biofilter is less than 200 Pa	Channelling through the media bed	Check filter media and spread it evenly
	Media completely dry, No spray on filter bed	Check water supply is ON Check strainer is clean Check pressure reducing valve is set up to the required pressure Check spray solenoid Check water flow switch
	Fan is running at low speed	Increase fan speed to the designed level.
3 Pressure Across Carbon is greater than 150 Pa	Pressure gauge is faulty	Check the gauges
	Carbon bed is wet Carbon bed is blocked	Check drainage
	Fan is running higher than design speed.	Adjust fan speed
4 Fan is shutdown	Power failure	Check power supply and circuit



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Problem	Possible Cause	Action
		breakers/fuses
	Airflow switch faulty Air flow rate is less than set point	Adjust/ replace airflow switch
	Fan current overload > 6 Amp	Check that the fan and motor bearings are running freely and that the fan is not fouled with particulates and water has pushed in the fan housing. Reset Overload on VFD & system
	Water flow rate is less than set point	Check main water supply valve is open and reset the system
5	Gas analyser not reading	Power failure, Check power supply, circuit breakers/fuses.
6	Outlet Gas analyser reading high >1 ppm	Calibration
		Check calibration is up-to-date
	Carbon tank is bypassed	Check butterfly valves handles are in the right position
	Carbon is consumed	Consider replacing carbon
7	Low pH < 3 in the sump	Calcium carbonate is consumed Replace the media.



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5. Equipment Specifications

Fan

Volume rate	m ³ /h	1000
Operating head	Pa	2500
Make	Aerotech Fans	
Type	Shrouded Radial Blade	
Model	HP183	
Drive Arrangement	Direct/ARR 4	
Materials of construction	Stainless Steel 316	
Motor power	kW	3
Number	1	
Supplier Address	3 Culverlands St, West Heidelberg , 3081 Victoria. Tel 03 9455 2700.	

BioFilter Housing

Make	CleanTeQ	
Type	6.2 m ³ Biofilter	
Size (Diameter X Height)	Ø2300mm x 2500mm (high)	
Surface area of media	m ²	4.15
Bed depth	m	1.5
Total volume BioFilter media:	m ³	6.2
Gas load (standardised to 1m)	m ³ /m ² .h	241
Pressure drop on start-up	Pa	310
Housing structure	Fibreglass	
Supplier Address	270-280 Hammond Rd, Dandenong Victoria. Tel 03 9797 6700	



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Activated Carbon Housing

Make	CleanTeQ	
Type	1.4 m ³ Biofilter	
Size (Diameter X Height)	Ø1500 mm x 1850 mm (high)	
Surface area of media	m ²	1.77
Bed depth	m	0.52
Total volume Carbon media:	m ³	0.91
Gas load	m ³ /m ² .h	565
Pressure drop on start-up	Pa	90
Housing structure	Fibreglass	
Supplier Address	270-280 Hammond Rd, Dandenong Victoria. Tel 03 9797 670	

Solenoid Valve

Make	Process Systems Pty Ltd
Model	S35-5-20-8N
Power	24 V DC
Number	1
Supplier	Corner Lytton & Ramsay Rd. Hemmant, Brisbane Phone 1300 887 880 Queensland 4174 Australia

Spray Nozzles & Assemblies

Model	W 1 ½, Part No. 26932, PVC .
Quantity	4 total
Supplier	Spray Nozzel Engineering 1-8/27 Shearson Crescent, Menton Victoria, 3194. Tel: 039583 2368

Acoustic Cover

Cover Material	V50 SONIC
Dimensions	L 935 X W 1050mm X H 900mm
Supplier	Flexshield Pty Ltd 5 Nans Rd, Helidon Qld 4344 Tel: 07 4697 6666



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Differential Pressure Gauge

Make	Dwyer
Model	Differential 2000Pa -2KPa
Number	2
Range	0-2000 Pa
Supplier	Corke Instrument Engineering 15 Export Drive , Brooklyn, Vic. Tel: 03 9362 4100

Air Flow Switch

Make	IFM Electronic
Type	Electric Sensor
Number	1
Model	SL5101
Power	24VDC
Supplier	IFM Efector Suite 3, 745 Springvale Road Mulgrave Vic 3170 Tel: 1300 365 088

Water Flow Switch

Make	GEMS Sensors
Type	Electric switch
Number	1
Model	FS-380P
Power	24VDC
Supplier	Control Components Pty Ltd Sales & Marketing Ph: 02 9542 8977



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Pressure Reducing Valve

Supplier	AVFI
Type	Direct Acting Control Valve
Number	1
Model	DMV-755-250
Supplier	54 Enterprise Drive Bundoora VIC 3083 Australia. (03) 8467 0000

Water Pressure Gauge

Type	Pressure Gauge
Model	SGL-F0724BT
Number	1
Range	0-800 KPa
Supplier	Corke Instrument Engineering Pty Ltd 15 Export Drive , Brooklyn, Vic. Tel: 03 9362 4100

Condensate Trap

Make	Norgren
Type	Air filter
Model	F73G-3GN-AD3
Number	4
Supplier	33 South Corporate Avenue, Rowville, Victoria 3178 Tel: +61 3 9213 0800 Fax: +61 3 9213 0890



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Gas Analyzers

Supplier

33 South Corporate Avenue, Rowville,
Victoria 3178
Tel: +61 3 9213 0800
Fax: +61 3 9213 0890

Option No.1		
Line No.	Draeger Part No.	Description
1	8317990	DOCKING STATION for POLYTRON 3000 & 7000
2	8317637	POLYTRON 7000 4-20 mA DISPLAY WITH PUMP
3	6809710	SENSOR H2S HC POLYTRON - dg
4	6810435	DRAGERSENSOR H2S POLYTRON - dg
5	3501080	FLOW KIT & MOISTURE TRAP



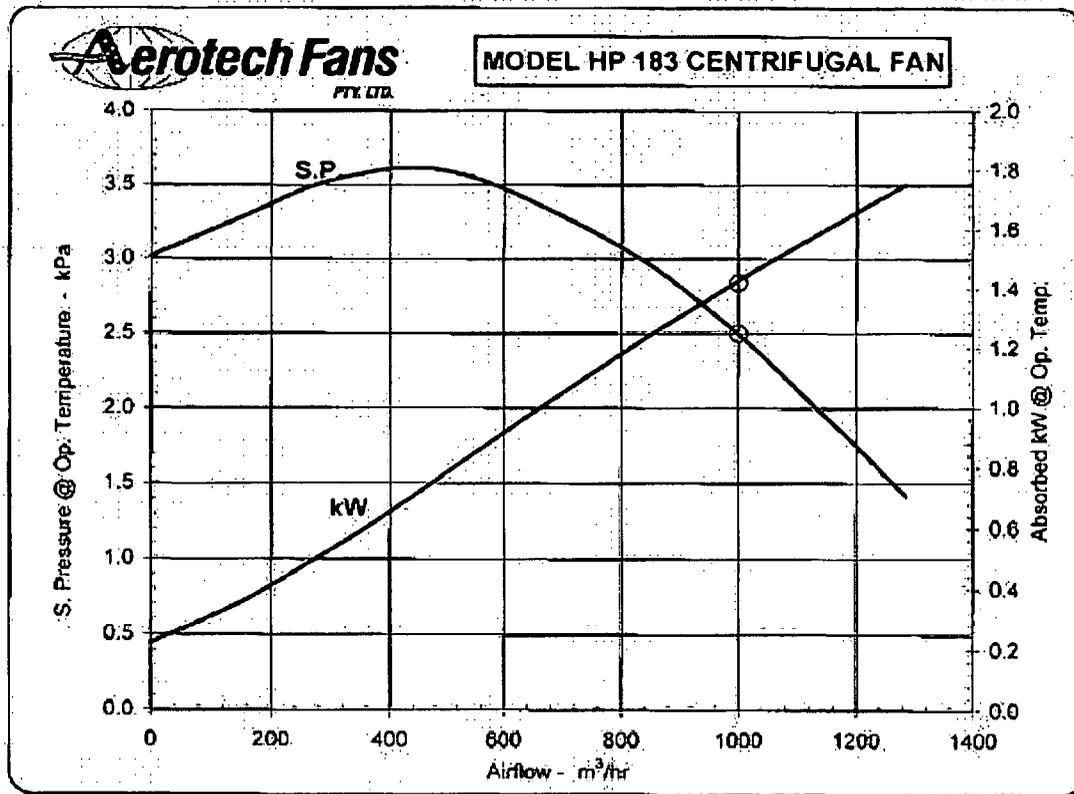
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6. Appendixes

The following section contains all data sheet and drawings for equipment used in the odour control plant. The following list summarizes all equipment used and related appendixes:

6.1	Fan Curve	Appendix 1
6.2	Fan Motor	Appendix 2
6.3	Flexible Joints	Appendix 3
6.4	Air Filters	Appendix 4
6.5	Gas Analysers	Appendix 5
6.6	Differential Pressure Gauges	Appendix 6
6.7	Butterfly Valves	Appendix 7
6.8	Spray Nozzles	Appendix 8
6.9	Solenoid Valve	Appendix 9
6.10	Water Flow Switch	Appendix 10
6.11	Air Flow Switch	Appendix 11
6.12	Rotameter	Appendix 12
6.13	Strainer	Appendix 13
6.14	Activated Carbon	Appendix 14
6.15	Ball Valves	Appendix 15
6.16	Pressure Reducing Valve	Appendix 16
6.17	Variable Frequency Drive	Appendix 17
6.18	Ventilation Damper	Appendix 18
6.19	P&ID	Appendix 19
6.20	Maintenance Report	Appendix 20
6.21	Design Program Data	Appendix 21
6.22	PLC Code	Appendix 22

APPENDIX 1



Fan impeller (wheel) diameter	mm	457
Fan speed	rpm	2710
Airflow @ fan inlet	m ³ /hr	1000
Inlet static pressure @ oper. temp.	kPa	0.0
Outlet static pressure @ oper. temp.	kPa	2.5
Allowance made for silencer loss	kPa	0.00
Total static pressure @ oper. temp.	kPa	2.5
Operating temperature	°C	20.0
Absorbed power @ operating temp.	kW	1.4
Absorbed power @ 20° C	kW	1.4
Fan efficiency	%	48.6

Altitude	m	0
Inlet density	kg/m ³	1.200
Tip speed	m/s	64.9
Outlet velocity	m/s	40.7
Inlet velocity	m/s	25.2
Approximate inlet diameter, I.D.	mm	118
Approximate outlet size - length	mm	111
Approximate outlet size - width	mm	62
Approximate casing diameter	mm	625
Fan casing thickness	mm	5.0
Lagging (cladding) thickness	mm	0.0

Octave band centre frequency, Hz	63	125	250	500	1000	2000	4000	8000	TOTAL	
Fan Internal Sound Power Level, dB	107	102	104	100	102	88	91	91.8	111	dB
Fan inlet or outlet S. Pressure L., dB	94	89	91	87	89	85	78	78.6	92	dBA
Casing breakout S. Pressure L., dB	80	74	72	64	63	58	49	49.3	69	dBA
Inlet or outlet S. Pressure L. with silencer, dB										dBA
Casing breakout with lagging, dB										dBA
Motor noise - free field, dBA @ 1metre										dBA

The above noise data is based on free field (no reflecting surface) conditions at 1 metre. If the fan is installed in an enclosed area, the final noise level would increase by approximately 3 dBA for single reflecting wall (floor), 5 dBA for two reflecting walls (floor and 1 wall), 8 dBA for three reflecting walls (floor and 2 walls i.e. corner). Noise levels do not include noises generated by bearings, vee belts, cooling fans etc. Casing breakout noise is through fan casing only and does not include breakout through ducting or flexible connections.

APPENDIX 2

MOTOR MANUAL

INSTALLATION AND MAINTENANCE INSTRUCTIONS
FOR ELECTRIC MOTORS

ENGLISH

INSTRUCCIONES PARA LA INSTALACIÓN Y
MANTENIMIENTO DE MOTORES ELÉCTRICOS

ESPAÑOL

BETRIEBS- UND WARTUNGSANLEITUNGEN
FÜR ELEKTROMOTOREN

DEUTSCH

INSTRUCTIONS POUR INSTALLATION ET
MANUTENTION DE MOTEURS ÉLECTRIQUES

FRANÇAIS

ISTRUZIONI D'USO E MANUTENZIONE
PER MOTORI ELETTRICI

ITALIANO

INSTALLATIONS- OG VEDLIGEHOLDELSVEJLEDNING
FOR ELEKTRISKE MOTORER

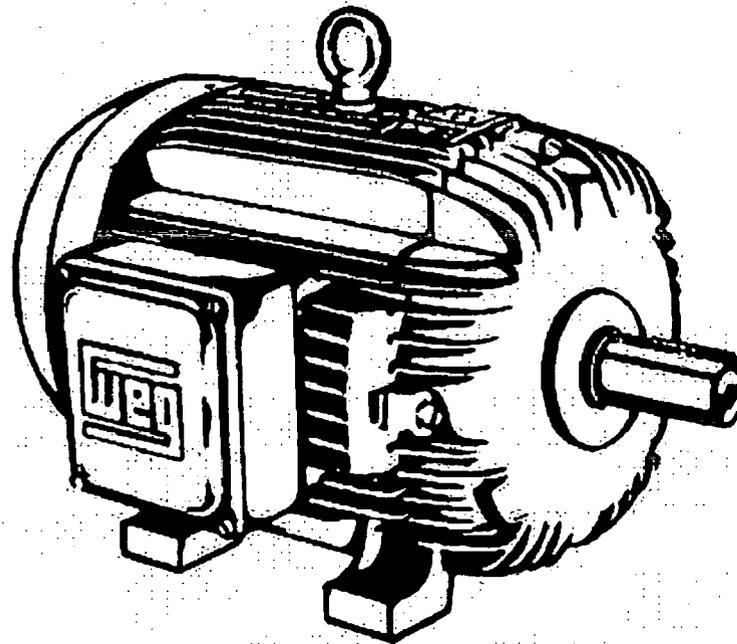
DANSK

INSTALLATIONS- OCH UNDERHÅLLSINSTRUKTIONER
FÖR ELEKTRISKA MOTORER

SVENSKA

ИНСТРУКЦИЯ ПО УСТАНОВКЕ И
ТЕХНИЧЕСКОМУ ОБСЛУЖИВАНИЮ
ЭЛЕКТРИЧЕСКИХ ДВИГАТЕЛЕЙ

РУССКИЙ



0280.1400

ENGLISH



**READ CAREFULLY THIS MANUAL
BEFORE INSTALLING THE MOTOR**

RECEIVING CHECK

Check if any damage has occurred during transportation.

- ✓ Check nameplate data.
- ✓ Remove shaft locking device (if any) before operating the motor.
- ✓ Turn the shaft with the hand to make sure it is turning freely.

HANDLING AND TRANSPORTATION

1 - General



**MOTORS MUST NOT BE LIFTED BY
THE SHAFT, BUT BY THE EYEBOLTS**

Lifting devices, when supplied, are designed only to support the motor. If the motor has two lifting devices then a double chain must be used to lift it.

Lifting and lowering must be done gently without any shocks, otherwise the bearings can get damaged.



**DURING TRANSPORTATION,
MOTORS FITTED WITH ROLLER OR
ANGULAR CONTACT BEARINGS
ARE PROTECTED AGAINST
BEARING DAMAGES WITH A
SHAFT LOCKING DEVICE.**



**THIS LOCKING DEVICE MUST BE
USED ON ANY FURTHER MOTOR
TRANSPORTATION, EVEN WHEN
THIS MEANS TO UNCOUPLE
THE MOTOR FROM THE DRIVEN
MACHINE.**

STORAGE

If motors are not immediately installed, they must be stored in dry places, free of dust, vibrations, gases, corrosive smokes, under constant temperature and in normal position free from other objects.

Motor storage temperature must remain between 5°C to 60°C, with relative humidity not exceeding 50%.

In case the motors are stored for more than two years, the bearings must be replaced or the lubrication grease must be totally removed after cleaning.

Single phase motors when kept in stock for 2 years or more must have their capacitors replaced (if any).

We recommend to turn the shaft (by hands) at least once a month, and to measure the insulation resistance before installing it, in cases of motors stored for more than 6 months or when subject to high humidity areas.

If motor is fitted with space heaters, these should be switched on.

Insulation Resistance Check

Measure the insulation resistance before operating the motor and/or when there is any sign of humidity in the winding.

The resistance measured at 25°C must be:

$$R_i \geq (20 \times U) / (1000 + 2P) \text{ [M}\Omega\text{]}$$

(measured with a MEGGER at 500 V d.c.)
where U = voltage (V); P = power (kW).

If the insulation resistance is less than 2 megaohms, the winding must be dried according to the following:

Warm it up inside an oven at a minimum temperature of 80°C, increasing 5°C every hour until 105°C, remaining under this temperature for at least one hour.

Check if the stator insulation resistance remains constant within the accepted values. If not, stator must be reimpregnated.

INSTALLATION

1 - Safety

All personnel involved with electrical installations, either handling, lifting, operation or maintenance must be well informed and updated concerning safety standards and principles that govern the work and carefully follow them.

We strongly recommend that these jobs are carried out by qualified personnel.

ENGLISH



MAKE SURE THAT ELECTRIC MOTORS ARE SWITCHED OFF BEFORE STARTING ANY MAINTENANCE SERVICE.

Motors must be protected against accidental starts.

When performing any maintenance service, disconnect the motor from the power supply. Make sure all accessories have been switched off and disconnected.

In order to prevent from penetrating dust and/or water into the terminal box, cable glands or threaded pipe in the lead holes must be installed.

Do not change the regulation of the protecting devices to avoid damaging.

2 - Operating Conditions

Electric motors, in general, are designed for operation at an altitude of 1000m above sea level for an ambient temperature between 0°C and 40°C. Any variation is stated on the nameplate.



COMPARE THE CURRENT, VOLTAGE, FREQUENCY, SPEED, OUTPUT AND OTHER VALUES DEMANDED BY THE APPLICATION WITH THE DATA GIVEN ON THE NAMEPLATE.

Motors supplied for hazardous locations must be installed in areas that comply with that specified on the motor nameplate.



KEEP AIR INLET AND OUTLET FREE AND CLEAN. THE AIR BLOWN OUT BY THE MOTOR SHALL NOT ENTER AGAIN. THE DISTANCE BETWEEN THE AIR INLET AND THE WALL MUST BE AROUND 1/4 OF THE INLET OPENING DIAMETER.

3 - Foundation

Motors provided with feet must be installed on solid foundations to avoid excessive vibrations.

The purchaser is fully responsible for the foundation.

Metal parts must be painted to avoid corrosion.

The foundation must be uniform and sufficiently tough to support any shock. It must be

designed in such a way to stop any vibration originated from resonance.

4 - Drain Holes

Make sure the drains are placed in the lower part of the motor when the mounting configuration differs from that specified on the motor purchase order.

5 - Balancing



WEG MOTORS ARE DYNAMICALLY BALANCED WITH HALF KEY, AT NO LOAD AND UNCOUPLED.

Transmission elements such as pulleys, couplings, etc must be dynamically balanced with half key before installation.

Use always appropriate tools for installation and removal.

6 - Alignment



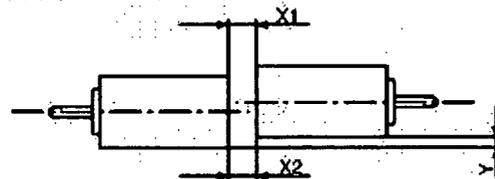
ALIGN THE SHAFT ENDS AND USE FLEXIBLE COUPLING, WHENEVER POSSIBLE.

Ensure that the motor mounting devices do not allow modifications on the alignment and further damages to the bearings.

When assembling a half-coupling, be sure to use suitable equipment and tools to protect the bearings.

Suitable assembly of half-coupling:

Check that clearance Y is less than 0.05 mm and that the difference X1 to X2 is less than 0.05 mm, as well.



Note: Dimension X1 and X2 must be 3mm minimum

Figure and alignment tolerances

7 - Belt Drive

When using pulley or belt coupling, the following must be observed:

Belts must be tighten just enough to avoid slippage when running, according to the

specifications stated on the belt supplier recommendation.

WARNING:
Excessive tension on the pulleys will damage the bearings and lead to a probable shaft rupture.

8 - Connection

WARNING:
Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

WARNING:
The capacitor on single-phase motors can retain a charge which appears across the motor terminals, even when the motor has reached standstill.

 **A WRONG CONNECTION CAN BURN THE MOTOR.**

Voltage and connection are indicated on the nameplate. The acceptable voltage variation is $\pm 10\%$, the acceptable frequency variation is $\pm 5\%$ and the total acceptable variation is $\pm 10\%$.

9 - Starting Methods

The motor is rather started through direct starting. In case this is not possible, use compatible methods to the motor load and voltage.

The rotation direction is clockwise if the motor is viewed from DE side and if the phases are connected according to the sequence L1, L2, L3.

To change the rotation direction, interchange two of the connecting leads.

 **THE CONNECTION TO THE POWER SUPPLY MUST BE DONE BY QUALIFIED PERSONNEL AND WITH FULL ATTENTION TO ASSURE A SAFE AND PERMANENT CONNECTION. AFTER CONNECTING THE MOTOR, CHECK FOR ANY STRANGE BODY INSIDE THE TERMINAL BOX. THE CABLE INLETS NOT IN USE MUST BE CLOSED.**

Make sure to use the correct cable dimension, based on the rated current stamped on the motor nameplate.

 **BEFORE ENERGIZING THE TERMINALS, CHECK IF THE GROUNDING IS MADE ACCORDING TO THE CURRENT STANDARDS. THIS IS ESSENTIAL AGAINST ACCIDENT RISKS.**

When the motor is supplied with protective or monitor temperature device such as thermostats, thermistors, thermal protector, etc, connect their terminals to the corresponding devices on the control panel.

10 - Start-Up

 **THE KEY MUST BE FASTENED OR REMOVED BEFORE STARTING THE MOTOR.**

a) The motor must start and operate smoothly. In case this does not occur, turn it off and check the connections and the mounting before starting it again.

b) If there is excessive vibration, check if the fastening screws are correctly fastened. Check also if the vibration comes from a neighbour machine. Periodical vibration checks must be done.

c) Run the motor under rated load for a short period of time and compare if the running current is equal to that stamped on the nameplate.

MAINTENANCE

 **WARNING: SAFETY CHECK LIST**

1 - General Inspection

- ✓ Check the motor periodically.
- ✓ Keep the motor clean and assure free air flow.
- ✓ Check the seals or V Ring and replace them, if required.
- ✓ Check the connections as well as supporting screws:
- ✓ Check the bearings and observe: Any excessive noise, vibration, bearing temperature and grease condition.
- ✓ When a change, under normal conditions, is detected, check the motor and replace the required parts.

ENGLISH

The frequency of the inspections depends on the motor type and on the application conditions.

LUBRICATION



1 - Machines without Grease Nipples

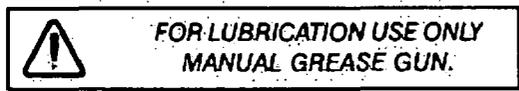
Motors up to frame 200 are normally fitted without grease nipples. In these cases the regreasing shall be done at the preventive maintenance job, observing the following aspects:

- ✓ Disassemble carefully the motors.
- ✓ Take all the grease out.
- ✓ Wash the bearing with querosene or diesel.
- ✓ Regrease the bearing immediately.

2 - Machines Fitted with Grease Nipples

It is strongly recommended to grease the machine while running. This allows the grease renewal in the bearing housing. When this is not possible due to turning parts by the grease device (pulleys, bushing, etc) that offer some risk to the physical integrity of the operator, proceed as follows:

- ✓ Clean the area near the grease nipple.
- ✓ Put approximately half of the total grease and run the motor for 1 minute at full speed. Then turn off the motor and insert the rest of the grease.
- ✓ The injection of all the grease with the motor in standstill can make the grease penetrate into the motor, through the inner seal of the bearing housing.



RELUBRICATION INTERVALS

TABLE 1 - BALL BEARINGS - Series 62/63													
Relubrication intervals: (running hours - horizontal position)													
	II pole		IV pole		VI pole		VIII pole		X pole		XII pole		Grease
Serie 62													
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
6209	18400	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	9
6211	14200	16500	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	11
6212	12100	14400	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	13
Serie 63													
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
6309	15700	18100	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	13
6311	11500	13700	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	18
6312	9800	11900	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	21
6314	3600	4500	9700	11600	14200	16400	17300	19700	19700	20000	20000	20000	27
6316	-	-	8500	10400	12800	14900	15900	18700	18700	20000	20000	20000	34
6319	-	-	7000	9000	11000	13000	14000	17400	17400	18600	18600	20000	45
6322	-	-	5100	7200	9200	10800	11800	15100	15100	15500	15500	19300	60

TABLE 2 - ROLLER BEARINGS - Series NU 3													
Relubrication intervals: (running hours - horizontal position)													
	II pole		IV pole		VI pole		VIII pole		X pole		XII pole		Grease
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
NU 309	9800	13300	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	19
NU 311	8400	9200	19100	20000	20000	20000	20000	20000	20000	20000	20000	20000	18
NU 312	5100	7600	17200	20000	20000	20000	20000	20000	20000	20000	20000	20000	21
NU 314	1600	2500	7100	8900	11000	13100	15100	16900	16900	19300	19300	20000	27
NU 316	-	-	6000	7600	9500	11600	13800	15500	15500	17800	17800	20000	34
NU 319	-	-	4700	6000	7600	9800	12200	13700	13700	15700	15700	20000	45
NU 322	-	-	3300	4400	5900	7800	10700	11500	11500	13400	13400	17300	60
NU 324	-	-	2400	3500	5000	6600	10000	10200	10200	12100	12100	15000	72

Note:

- ✓The ZZ bearings from 6201 to 6307 do not require relubrication as its life time is about 20,000 hours.
- ✓Tables 1 and 2 are intended for the lubrication period under bearing temperature of 70°C (for bearings up to 6312 and NU 312) and temperature of 85°C (for bearings 6314 and NU 314 and larger).
- ✓For each 15°C of temperature rise, the relubrication period is reduced by half.
- ✓The relubrication periods given above are for those cases applying Polyrex® EM grease.
- ✓When motors are used on the vertical position, their relubrication interval is reduced by half if compared to horizontal position motors.

 **WE RECOMMENDED TO USE BALL BEARINGS FOR MOTORS DIRECTLY COUPLED TO THE LOAD.**

 **WARNING:
EXCESS OF GREASE CAN CAUSE BEARING OVERHEATING RESULTING IN COMPLETE DAMAGE.**

Compatibility of Polyrex® EM grease with other types of grease:

Containing polyurea thickener and mineral oil, the Polyrex® EM grease is compatible with other types of grease that contain:

- ✓Lithium base or complex of lithium or polyurea and highly refined mineral oil.
- ✓Inhibitor additive against corrosion, rust and anti-oxidant additive.

Notes:

- ✓Although Polyrex® EM is compatible with types of grease given above, we do not recommended to mix it with any other greases.
- ✓If you intend to use a type of grease different than those recommended above, first contact WEG.
- ✓On applications (with high or low temperatures, speed variation, etc), the type of grease and relubrication interval are given on an additional nameplate attached to the motor.

 **THE USE OF STANDARD MOTORS IN SPECIFIC AREAS OR SPECIAL APPLICATIONS MUST BE DONE BY CONSULT TO THE GREASE MANUFACTURER OR WEG.**

DISASSEMBLY AND ASSEMBLY

Disassembly and assembly must be done by qualified personnel using only suitable tools and appropriated methods.

The stator grips must be applied over the side face of the inner ring to be disassembled or over an adjacent part.

It is essential that bearings assembly be done under cleaning conditions to ensure good operation and to avoid damages. New bearings shall only be taken out from their cases when assembling them.

Before installing a new bearing it is required to check the shaft fitting for any sharp edge or strike signals.

For bearing assembly warm their inner parts with suitable equipment - inductive process - or use suitable tools.

SPARE PARTS

When ordering spare parts, please specify the full type designation and product code as stated on the motor nameplate. Please also inform the motor serial number stated on the nameplate.

MOTORS FOR HAZARDOUS LOCATIONS

Besides the recommendations given previously, these ones must be also followed:

 **THE SPECIFICATION OF THE MOTOR INSTALLATION PLACE IS FOR CUSTOMER'S RESPONSIBILITY, WHO WILL ALSO DETERMINE THE ENVIRONMENT CHARACTERISTICS.**

Motors for hazardous locations are manufactured according to specific standards for such environments and they are certified by worldwide certifying entities.

1 - Installation

The complete installation must follow procedures given by the local legislation in effect.

 **THE INSTALLATION OF HAZARDOUS LOCATION MOTORS MUST BE CARRIED OUT BY SKILLED PEOPLE, AND THE THERMAL PROTECTION MUST BE ALWAYS INSTALLED, EITHER INSIDE OR OUTSIDE THE MOTOR, OPERATING AT THE RATED CURRENT.**

2 - Maintenance

Maintenance must be carried out by repair shops authorized by WEG.

Repair shops and people without Weg's authorization who will perform any service on hazardous location motors will be fully responsible for such service as well as for any consequential damage.

 **ANY ELECTRICAL OR MECHANICAL MODIFICATION MADE ON HAZARDOUS LOCATION MOTORS WILL VOID THE CERTIFICATION.**

When performing maintenance, installation or relubrication, follow these instructions:

- ✓ Check if all components are free of edges, knocks or dirt.
- ✓ Make sure all parts are in perfect conditions.
- ✓ Lubricate the surfaces of the endshield fittings with protective oil to make the assembly easier.
- ✓ Use only rubber hammer to fit the parts.
- ✓ Check for correct bolts tightening.
- ✓ Use clearance calibrator for correct T-box fitting (smaller than 0.05mm).

 **DO NOT REUSE DAMAGED OR WORN PARTS. REPLACE THEM BY NEW ONES SUPPLIED BY THE FACTORY.**

MOTORS DRIVEN BY VFD

Applications using VFD's without filter can affect motor performance as follows:

- ✓ Lower efficiency.
- ✓ Higher vibration.
- ✓ Higher noise level.
- ✓ Higher rated current.
- ✓ Higher temperature rise.
- ✓ Reduced motor insulation.
- ✓ Reduced bearing life.

1- Standard Motors

- ✓ Voltages lower than 440V do not require filter.
- ✓ Voltages equal or higher than 440V or lower than 575V require filter for motor power supply cables longer than 20 meters.
- ✓ Voltages equal or higher than 575V require filter for any size of power supply cables.

 **IF SUCH RECOMMENDATIONS ARE NOT FOLLOWED ACCORDINGLY, MOTOR WARRANTY WILL BE VOID.**

2- Inverter Duty Motors:

- ✓ Check power supply voltage of the forced cooling set.
- ✓ Filters are not required.

WARRANTY TERMS

Weg warrants its products against defects in workmanship and materials for twelve (12) months from the invoice date issued by the manufacturer, authorized distributor or agent limited to eighteen (18) months from manufacturing date independent of installation date as long as the following items are fulfilled accordingly:

- Proper transportation, handling and storage;
- Correct installation based on the specified ambient conditions and free of corrosive gases;
- Operation under motor capacity limits;
- Observation of the periodical maintenance services;
- Repair and/or replacement effected only by personnel duly authorized in writing by Weg;
- The failed product be available to the supplier and/or repair shop for a required period to detect the cause of the failure and corresponding repair;
- Immediate notice by the purchaser about failures accrued and that these are accepted by Weg as manufacturing defects.

This warranty does not include disassembly services at the purchaser facilities, transportation costs with product, tickets, accommodation and meals for technical personnel when requested by the customer. The warranty service will be only carried out at Weg Authorized Repair Shops or at Weg's facilities.

Components whose useful life, under normal use, is shorter than the warranty period are not covered by these warranty terms. The repair and/or replacement of parts or components, when effected by Weg and/or any Weg Authorized Repair Shop, will not give warranty extension.

This constitutes Weg's only warranty in connection with this sale and the company will have no obligation or liability whatsoever to people, third parties, other equipment or installations, including without limitation, any claims for consequential damages or labor costs.



APPENDIX 3

MERLYN
PRODUCTS PTY LTD
ACN 83 010 837975

P.O. Box 367
Springwood QLD 4127
AUSTRALIA
16 Lapis Str
Underwood QLD 4119
Ph 61 7 38082224
Fax 61 7 32080279
E-mail sales@merlynproducts.com.au

8130 XR-5 Fabric

Xr-5 is an extremely tough woven composite fabric using polyester fibres that have been molecularly coated with sophisticated compounds that are minimally degradable in adverse environments. Combined, liner and coatings offer a unique balance of performance features and durability that have not been achieved by any other manufacturer of environmental liner fabrics. The fabric is made up of 3 layers as detailed below; -

- 1) Inner Layer - this has impressive dimensional stability, tensile strength and puncture resistance as a function of the base fabric for XR-5. This is a proprietary weave design using polyester fibres to provide maximum strength to weight ratios, flexibility and ease of handling.
- 2) Middle Layers - Exclusive molecular primers saturate the woven fibres in the second step of manufacture. This saturation makes possible the bonding of substrate and coating compound into a single system. As a result there is no delamination possible and no edge coating required.
- 3) Outer Layers - XR-5 has one side coated per pass which assures an excellent bonding process and a high quality finished product. The exclusive coating compound contains DuPont Elvaloy and is essentially non crystalline and therefore not susceptible to environmental stress cracking.

XR-5 has many uses however Merlyn Products Pty Ltd has used the fabric extensively as a low to medium temperature range expansion joint fabric. Its excellent weather and UV resistant properties make it ideal for this application in both in door and outdoor use.

Physical properties are detailed below.

PHYSICAL PROPERTIES

MATERIAL SPECIFICATION

Property	Test Method	Requirement
1. Thickness	ASTM 751	30±2 MILL (8130) (0.7mm)
2. Weight	ASTM D-751	30.0± 2 oz. /sq. yd. (8130)
3. Tear Strength	ASTM D-751	125 lbs. /125 lbs.
4. Breaking Yield Strength	ASTM-D-751 Grab Tensile	475 lbs. /425 lbs.
5. Low Temperature	ASTM-D-2136 4 hrs. - 1/8" mandrel	-30°F. No cracking
6. Dimensional Stability	ASTM-D-1204	2% max.
7. Hydrostatic Resistance	ASTM-D-751 Method A	500 psi (min.)
8. Blocking Resistance 180°F.	Method 5872 Fed. Std. 191a	#2 Rating Max.
9. Max. Temp. Op. Temp.		100°C 90°C
10. Adhesion-Ply. lbs./in. of width	ASTM-D-413 2" per min.	9 lbs. /inch (min.) Or film tearing bond
11. Adhesion - heat sealed Seam lbs. /in. of width	ASTM-D-751	10 lbs. /in. (min.)
12. Dead Load Seam shear strength	MIL-T-52983E Para. 4.5.2.19 2" overlap seam	Must withstand 210 lbs. /in. @ 70°F. 105 lbs. /in. @ 160°F.
13. Abrasion Resistance (Taber Method)	Method 5306 Fed. Std. 191a H-18 Wheel 1000 gm. load	2000 cycles before fabric exposure 50 mg. /100 cycles max. Wt. Loss
14. Weathering Resistance	Carbon-Arc Atlas Weather-o-meter	2,000 hrs. No Appreciable changes or stiffening or cracking or coating
15. Water Absorption	ASTM-D-471 7 days	5% max. @ 70°F. 12% max. @ 212°F.
16. Wicking	Shelter-Rite procedure	1/8" max.
17. Puncture Resistance	FTMS 101B Method 2031	350 lbs.

APPENDIX 4



F73G

Excelon 73 General Purpose Filter 1/4", 3/8", 1/2" Port Sizes

Excelon design allows in-line or modular installation

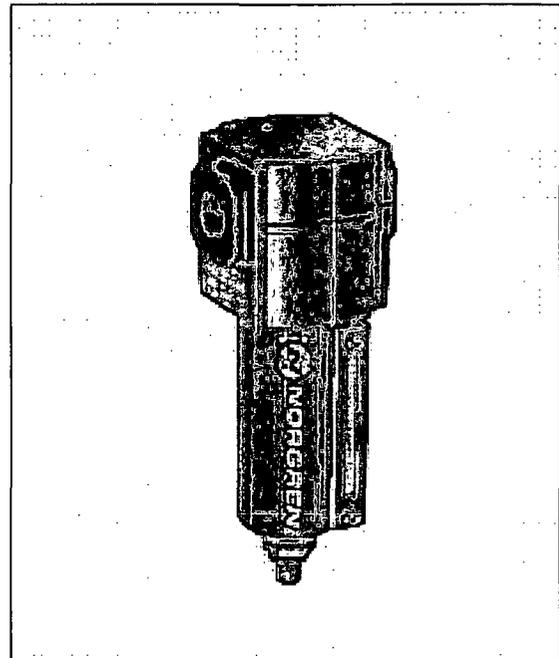
Quick release bayonet bowl

Highly visible, prismatic liquid level indicator lens

Optional mechanical service indicator turns from green to red when the filter element needs to be replaced

Optional electrical service indicator provides electrical output when the filter element needs to be replaced

Modular installations with Excelon 72, 73, and 74 series can be made to suit particular applications



Ordering information. Models listed include PTF threads, automatic drain, metal bowl with liquid level indicator, and a 40 µm element.

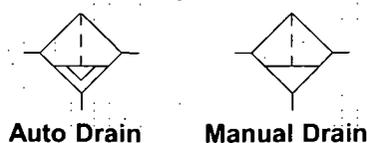
Port Size	Model	Flow* scfm (dm³/s)	Weight lb (kg)
1/4"	F73G-2AN-AD3	53 (25)	1.1 (0.50)
3/8"	F73G-3AN-AD3	65 (31)	1.1 (0.50)
1/2"	F73G-4AN-AD3	69 (33)	1.1 (0.50)

* Typical flow with a 40 µm element at 90 psig (6.3 bar) inlet pressure and 5 psig (0.35 bar) pressure drop.

Alternative Models

F 7 3 G - ★ ★ ★ - ★ ★ ★																					
<table border="1" style="width: 100%;"> <thead> <tr> <th>Port Size</th> <th>Substitute</th> </tr> </thead> <tbody> <tr> <td>1/4"</td> <td>2</td> </tr> <tr> <td>3/8"</td> <td>3</td> </tr> <tr> <td>1/2"</td> <td>4</td> </tr> </tbody> </table>	Port Size	Substitute	1/4"	2	3/8"	3	1/2"	4				<table border="1" style="width: 100%;"> <thead> <tr> <th>Element</th> <th>Substitute</th> </tr> </thead> <tbody> <tr> <td>5 µm</td> <td>1</td> </tr> <tr> <td>25 µm</td> <td>2</td> </tr> <tr> <td>40 µm</td> <td>3</td> </tr> </tbody> </table>	Element	Substitute	5 µm	1	25 µm	2	40 µm	3	
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ISO Symbols



See Section ALE-24 for Accessories

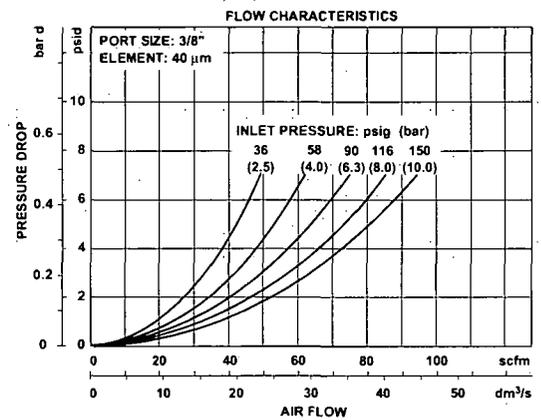
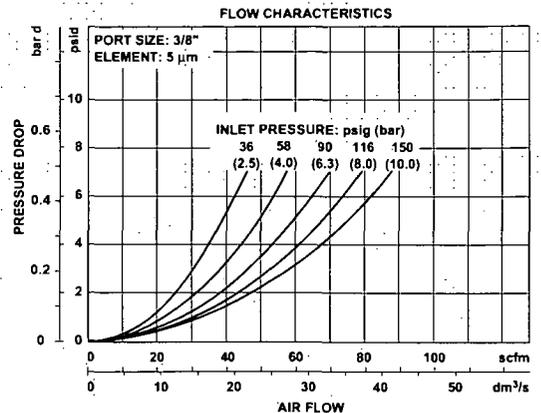
F73G General Purpose Filters



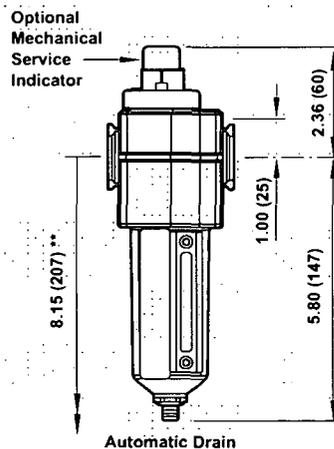
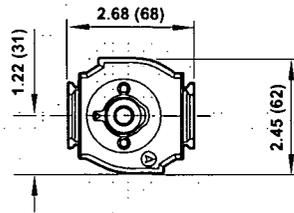
Technical Data

Fluid: Compressed air
 Maximum pressure:
 Transparent bowl: 150 psig (10 bar)
 Metal bowl: 250 psig (17 bar)
 Operating temperature*:
 Transparent bowl: -30° to 125°F (-34° to 50°C)
 Metal bowl: -30° to 175°F (-34° to 80°C)
 * Air supply must be dry enough to avoid ice formation at temperatures below 35°F (2°C).
 Particle removal: 5 µm, 25 µm, or 40 µm filter element
 Air quality: Within ISO 8573-1, Class 3 and Class 5 (particulates)
 Typical flow with a 40 µm element at 90 psig (6.3 bar) inlet pressure and 5 psig (0.35 bar) pressure drop: 65 scfm (31 dm³/s)
 Manual drain connection: Will fit 1/8-27 and 1/8-28 pipe thread.
 Automatic drain connection: Will fit 1/8-27 and 1/8-28 pipe thread. - Flexible tube with 3/16" (5mm) minimum I.D. can be connected to the automatic drain. Drain may fail to operate if the tube I.D. is less than 3/16" (5mm). Avoid restrictions in the tube.
 Automatic drain operating conditions (float operated):
 Bowl pressure required to close drain: Greater than 5 psig (0.3 bar)
 Bowl pressure required to open drain: Less than 3 psig (0.2 bar)
 Minimum air flow required to close drain: 0.2 scfm (0.1 dm³/s)
 Manual operation: Depress pin inside drain outlet to drain bowl
 Nominal bowl size: 3.5 fluid ounce (0.1 liter)
 Materials
 Body: Aluminum
 Bowl
 Transparent: Polycarbonate
 Transparent with guard: Polycarbonate, steel guard
 Metal: Aluminum
 Metal bowl liquid level indicator lens: Transparent nylon
 Element: Sintered polypropylene
 Elastomers: Neoprene and nitrile
 An automatic drain is a two-way valve, which will close when the system is pressurized. The drain opens when the float rises due to accumulated liquid and on depressurization.

Typical Performance Characteristics



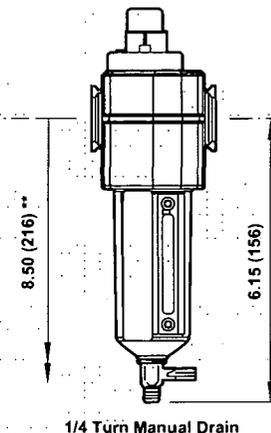
All Dimensions in Inches (mm)



Service Kits

Item	Type	Part Number
Service kit	Seal & Gasket	4380-600
Replacement elements	5 µm	4438-01
	25 µm	4438-02
	40 µm	4438-03
Liquid level lens kit	Prismatic	4380-020
Replacement drains	Automatic	4000-51R
	Manual quarter turn	619-50

Service kit includes automatic drain seal and bowl seal.



** Minimum clearance required to remove bowl.



Littleton, CO USA

Phone 303-794-2611

www.norgren.com

ALE-1-7

APPENDIX 5

Dräger Polytron 7000 Fixed gas detector



The Dräger Polytron 7000 is a gas detector that can satisfy all toxic and oxygen gas measurement applications on a single platform. It is meeting the requirements of the compliance market as well as the high specification requirements of customized solutions. Developed with an innovative modular design, there is now the flexibility to choose and purchase only the features that the application requires. The unit is upgradeable to a higher specification after it has been installed simply by adding modules. This allows the Dräger Polytron 7000 to develop in line with changing application requirements.

Intuitive operation

The software menu of the Dräger Polytron 7000 was designed in partnership with our customers making it simple and easy to use. The large graphical display uses icons and plain text to show the status of the instrument, and guides the user through calibration and configuration.

Intelligent sensors

Dräger Polytron 7000 is able to detect over 100 different gases. Specifically designed for the demanding requirements of a 24 hours a day, 365 days a year stationary gas detection system, the larger DrägerSensor are renowned for their long life times and superior performance. The embedded sensor memory contains all relevant sensor data. All this enables the use of pre-calibrated sensors, which makes the Dräger Polytron 7000 ideal for a virtually maintenance free transmitter.

Communication interfaces

With the Dräger Polytron 7000 the communication to the central control system can be selected between 4 to 20 mA or digital options as: HART®, FOUNDATION fieldbus™ H1, PROFIBUS®

PA or LONWORKS*. With the digital options, the Dräger Polytron 7000 can be integrated into any LONWORK*, PROFIBUS® or FOUNDATION fieldbus™ system architecture. Offering the advantage of reduced wiring cost and enabling the remote diagnosis and predictive maintenance functionality for a reliable and flexible communication network.

Software Options

A number of software dongles with different software functionality will customize the transmitter to specific application needs.

Sensor Test Dongle

With this dongle, the Dräger Polytron 7000 performs many patented sensor tests to ensure reliability and functionality of the sensor and the gas detection system.

Sensor Diagnostic Dongle

All sensors have a certain life time which can be affected by factors such as gas exposure, temperature exposure and the age of the sensor. Now, with the new sensor diagnostic function in the dongle (including Sensor Test), the stress and remaining life of the sensor is evaluated, and it is possible to predict and plan for a maintenance and replacement cycle.



Dräger Polytron 7000:
Intrinsically safe gas
detector for toxic gases
and oxygen in ambient air.

DRÄGER POLYTRON 7000

Data Dongle

Datalogger and eventlogger options are implemented in this dongle, which stores gas values and events such as faults and alarms. Using an IR link with the PDA m515-Ex, the data can be downloaded and evaluated on a PC with the GasVision software. By pushing one button, a graphical 15 minute history of the gas concentration will be displayed on the transmitter screen, for quick evaluation of the current and past situation.

Rugged Housing

The design of the compact durable GRP housing of the Dräger Polytron 7000 is dust and water proof with an IP66/67 and NEMA 4 rating. It is verified to SIL 2 specification with unsurpassed RFI resistance.

Relay Module

The Dräger Polytron 7000 can be equipped with a relay module to make it a stand alone device with two gas alarms and one fault relay. The relay module forms a part of transmitter, so there is no additional installation cost or wiring to be done. For general purpose use only.*

Large Display

34 x 62 mm, 64 x 128 pixel 1.3" x 2.4"

Quick Lock mechanism

One half turn – locked

Simple 3 button operation and navigation

Graphics, icons and real text descriptions

Polytron Docking station

Durable GRP housing

**Simple, quick installation**

The Dräger two component concept of a Docking Station and a Dräger Polytron 7000 electronics saves time and money. The Docking Station can be pre-installed – mounting and wiring it into place separately – while protected by a rain and dust cover until commissioning. At commissioning, the Dräger Polytron 7000 electronics is fixed by quicklock mechanism into the Docking Station, the sensor inserted and the system is ready for operation.

Pump Module

An internal pump for sampling the gas mixture to the sensor is also a module option. The pump fits inside the Dräger Polytron 7000 with no additional need for extra wiring and mounting space. For general purpose use only.*

Accessories / Remote Sensor

The remote sensor is easy to install on the wall or, using the duct adapter, onto ducts and pipes.

ORDER INFORMATION

Dräger Polytron 7000 with 4 to 20 mA output and Sensor Diagnostic Dongle 83 17 980

Dräger Polytron 7000 variations

4 to 20m A	HART®	Relay	Pump	
*				83 17 610
*		*		83 17 636*
*			*	83 17 637*
*		*	*	83 17 638*
*	*			83 17 710
*	*	*		83 17 776*
*	*		*	83 17 777*
*	*	*	*	83 17 778*

PROFIBUS® FOUNDATION PA	FOUNDATION fieldbus™ H1	LON	Relay	Pump	
		*			83 17 810*
		*	*		83 17 816*
		*		*	83 17 817*
		*	*	*	83 17 818*
*					83 19 430
*			*		83 19 427*
*				*	83 19 436*
*			*	*	83 19 438*
	*				83 19 440
	*		*		83 19 428*
	*			*	83 19 437*
	*		*	*	83 19 439*

Dräger Polytron Docking Station – one required per transmitter 83 17 990

Modules

Pump Module	83 17 350
Relay Module	83 17 360
Relay Connector	18 90 086

Software Dongles

Data Dongle	83 17 618
Sensor Test Dongle	83 17 619
Sensor Diagnostic Dongle	83 17 860

Accessories

Remote Sensor Adapter	83 17 275
Remote Cable and plug 5 m / 16 ft.	83 17 270
Remote Cable and plug 15 m / 49 ft.	83 17 998
Remote Cable and plug 30 m / 100 ft.	83 17 999
Remote duct adapter	83 17 617
Duct Mounting Kit	83 17 150
Cable Entry Set M20, with cable gland and connector for multi-drop	83 17 282
Calibration Adapter, electrochemical sensors	68 06 978
Pump Adapter for DrägerSensor AC L	83 17 976
Calibration Adapter, DrägerSensor AC L	68 09 380
Dräger GasVision, data display software	83 14 034
Dräger CC-Vision, calibration and configuration software	64 08 515
IR data cable, USB DIRA	83 17 409
PDA m515-Ex	83 17 995

8T-3814-2003



Dräger Polytron 7000:
With internal pump.*

3T-3816-2003



Dräger Polytron 7000:
With integrated relays.*

3T-3821-2003



Dräger Polytron 7000:
With remote sensor and remote cable up to 30 m / 100 ft.

TECHNICAL INFORMATION

Typ	Intrinsically safe transmitter for electrochemical sensors	
Gases and Ranges	Toxic gases and oxygen, ranges user adjustable, see sensor data sheet	
Display	Large graphic display, 34 x 62 mm, 64 x 128 pixel 1.3" x 2.4" Menu structure and messages in real text, 3 button navigation	
Output	Analog	4 to 20 mA
	Digital	HART®, LONWORKS®, PROFIBUS®, FOUNDATION fieldbus™
	Warning signal, configurable	default: warning signal every 10s for 1s
	Maintenance signal, configurable	3.4 mA constant or 4 mA ± 1 mA, 1 Hz modulation
	Fault signal	< 3.2 mA
Power Supply	16,5 to 30VDC 2-Wire, 3-Wire for Pump module* and relay module*	
Pump Module*	Tubing up to 30m / 100ft. @ 0.5 l/min with 4mm / 3/16" inner diameter	
Relay Module*	Two alarm relays, one fault relay, SPDT, user programmable Rating 5A 240VAC, 5A 24VDC	
Ambient Conditions	Transmitter only, for sensors see separate sensor data sheet	
	Temperature	-40 to +65 °C / -40 to +150 °F
	Pressure	700 to 1300 hPa / 23.6 to 32.5 inch Hg
	Humidity	0 to 100 %RH, non condensing
Enclosure	GRP, IP 66/67, NEMA 4, M20 cable gland	
Size (h x w x d)	166 x 135 x 129 mm, 6.54 "x 5.32" x 5.08" ft.	
Weight	Approx. 900 g / 2 lbs.	
SIL Level	SIL 2 verified	
Approvals	ATEX	II 1G EEx ia IIC T6/T4, - 40 to + 40 / + 65 °C
		II 3G EEx nL IIC T6, - 25 to + 40 °C
		II 3D IP6x T65°C
	IEC	Ex ia IIC T6/T4, - 40 to + 40 / + 65 °C
	UL	Class I, Div 1, Group A, B, C, D, Class II, Div 1, Group E, F, G
	CSA	Class I, Div 1, Group A, B, C, D Ex ia IIC T6/T4, - 40 to + 40 / + 65 °C
	CE-mark	electromagnetic compatibility (directive 89/336/EEC) low voltage directive (72/23/EEC, 93/68/EEC)

HART® is a registered trademark of the HART Communication Foundation
LONWORKS® is a registered trademark of the Echelon Corporation
FOUNDATION fieldbus™ is a registered trademark of the Fieldbus Foundation™

*general purpose use only. The transmitter does not have any approval, but the CE-mark when used with LON. a pump or relay module

SYSTEM CENTERS
P. R. CHINA

Beijing Fortune Draeger
Safety Equipment Co., Ltd.
Yu An Lu A 22, B Area
Beijing Tianzhu Airport
Industrial Zone
Houshayu Shunyi District
Beijing 101300
Tel +86 10 80 49 80 00
Fax +86 10 80 49 80 05

FRANCE

Draeger Safety France S.A.S.
3c, Route de la Fédération
67025 Strasbourg Cedex
Tel +33 388 40 76 76
Fax +33 388 40 76 67

SINGAPORE

Draeger Safety Asia Pte. Ltd.
67, Ayer Rajah Crescent # 06 03
139950 Singapore
Tel +65 68 72 92 88
Fax +65 67 73 20 33

UNITED KINGDOM

Draeger Safety UK Ltd.
Blyth Riverside Business Park
Blyth, Northumberland NE24 4RG
Tel +44 1670 352 891
Fax +44 1670 544 475

USA

Draeger Safety, Inc.
505 Julie Rivers, Suite 150
Sugar Land, TX 77478
Tel +1 281 498 1082
Fax +1 281 498 5190

Draeger Safety AG & Co. KGaA

Revalstrasse 1
23560 Luebeck, Germany
Tel +49 451 882 2794
Fax +49 451 882 4991
www.draeger.com

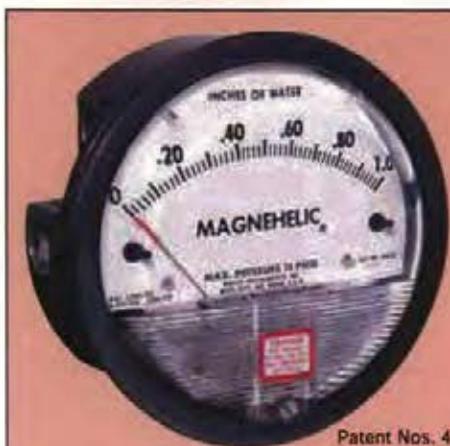
APPENDIX 6



Series 2000

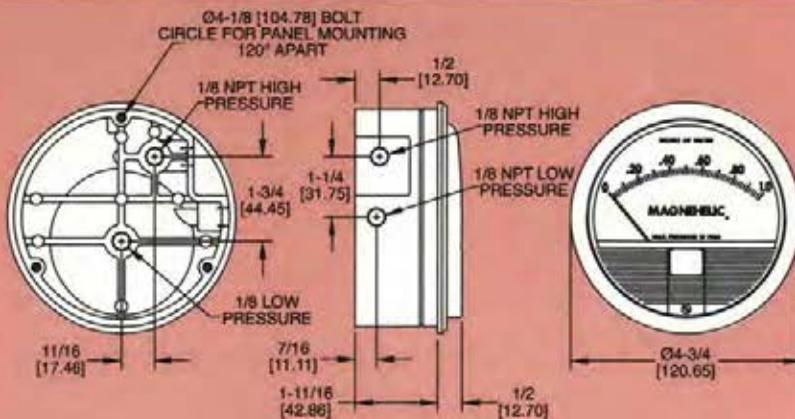
Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



Patent Nos. 4,030,365
5,012,878

Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer® Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Note: May be used with Hydrogen. When ordering a Buna-N diaphragm pressures must be less than 35 psi.

MOUNTING. A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610



Flush ...Surface...or Pipe Mounted

Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1½" - 2" pipe. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4/16" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

VENT VALVES

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.



HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4/16" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.



SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)

Wetted Materials: Consult factory

Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.

Accuracy: ±2% of full scale (±3% on -0, -100 Pa, -125 Pa, 10MM and ±4% on -00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).

Pressure Limits: -20" Hg. to 15 psig.1 (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).

Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.

Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).

Size: 4" (101.6 mm) Diameter dial face.

Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.

Process Connections: 1/8" female NPT duplicate high and low pressure taps - one pair side and one pair back.

Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).

Standard Accessories: Two 1/8" NPT plugs for duplicate pressure taps, two 1/8" pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)

*Low temperature models available as special option.

†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent Overlays

Furnished in red and green to highlight and emphasize critical pressures.



Adjustable Signal Flag

Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.



LED Setpoint Indicator

Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.



Portable Units

Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft. (2.7 m) of 3/8" I.D. rubber tubing, standhang bracket and terminal tube with holder.



Air Filter Gage Accessory Package

Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of 1/4" aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

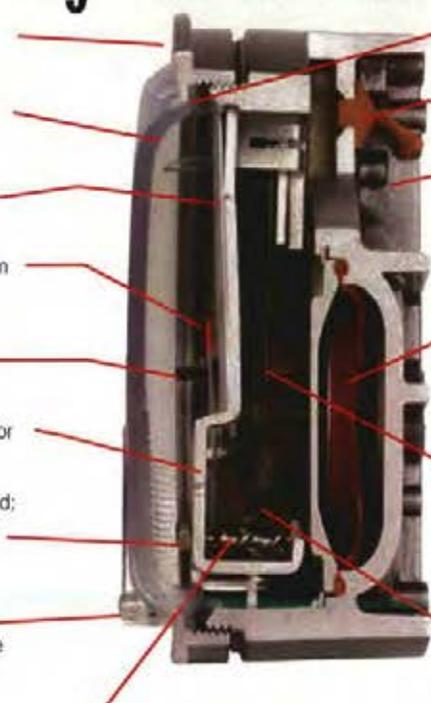
Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.



O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

Die cast aluminum case is precision made and indite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

MODELS

Dual Scale English/Metric Models		
Model Number	Range, In. W.C.	Range, Pa or kPa
2000-00	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa

SERIES 2000 MAGNEHELIC® GAGE — MODELS AND RANGES

The models below will fulfill most requirements. Page 479 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range Inches of Water	Model Number	Range Zero Center Inches of Water	Dual Scale Air Velocity Units		Model Number	Range, CM of Water	Model Number	Range, Pascals
				Model Number	Range in W.C. Velocity, F.P.M.				
2000-00N1**	.05-0-2	2300-01*	.25-0-25	2000-00AV1**	0-25/300-2000	2000-15CM	0-15	Zero Center Ranges	
2000-001**	0-25	2301	.5-0-5	2000-0AV1*	0-50/500-2800	2000-20CM	0-20	2300-60PA	30-0-30
2000-01*	0-50	2302	1-0-1	2001AV	0-1.0/500-4000	2000-25CM	0-25	2300-100PA	50-0-50
2001	0-1.0	2304	2-0-2	2002AV	0-2.0/1000-5600	2000-50CM	0-50	2300-120PA	60-0-60
2002	0-2.0	2310	5-0-5	2010AV	0-10/2000-12500	2000-80CM	0-80	2300-250PA	125-0-125
2003	0-3.0	2320	10-0-10	For use with pitot tube.		2000-100CM	0-100	2300-500PA	250-0-250
2004	0-4.0	2330	15-0-15	Model Number	Range MM of Water	2000-150CM	0-150		
2005	0-5.0			2000-6MM1**	0-6	2000-200CM	0-200		
2006	0-6.0			2000-10MM1*	0-10	2000-250CM	0-250		
2008	0-8.0			2000-25MM	0-25	2000-300CM	0-300		
2010	0-10	2201	0-1	2000-50MM	0-50	Zero Center Ranges		Model Number	Range, Kilopascals
2015	0-15	2202	0-2	2000-80MM	0-80	2300-4CM	2-0-2	2000-1KPA	0-1
2020	0-20	2203	0-3	2000-100MM	0-100	2300-10CM	5-0-5	2000-1.5KPA	0-1.5
2025	0-25	2204	0-4			2300-30CM	15-0-15	2000-2KPA	0-2
2030	0-30	2205	0-5					2000-3KPA	0-3
2040	0-40	2210*	0-10					2000-4KPA	0-4
2050	0-50	2215*	0-15					2000-5KPA	0-5
2060	0-60	2220*	0-20					2000-8KPA	0-8
2080	0-80	2230**	0-30					2000-10KPA	0-10
2100	0-100							2000-15KPA	0-15
2150	0-150							2000-20KPA	0-20
								2000-25KPA	0-25
								2000-30KPA	0-30
								Zero Center Ranges	
								2300-1KPA	.5-0-5
								2300-3KPA	1.5-0-1.5

Accessories

- A-299, Surface Mounting Bracket
- A-300, Flat Flush Mounting Bracket
- A-310A, 3-Way Vent Valve
- A-321, Safety Relief Valve
- A-432, Portable Kit
- A-605, Air Filter Kit
- A-610, Pipe Mount Kit

Options — To order, add suffix: I.E. 2001-ASF
 ASF (Adjustable Signal Flag)
 HP (High Pressure Option)
 LT (Low Temperatures to -20°F)
 MP (Med. Pressure Option)
 SP (Setpoint Indicator)

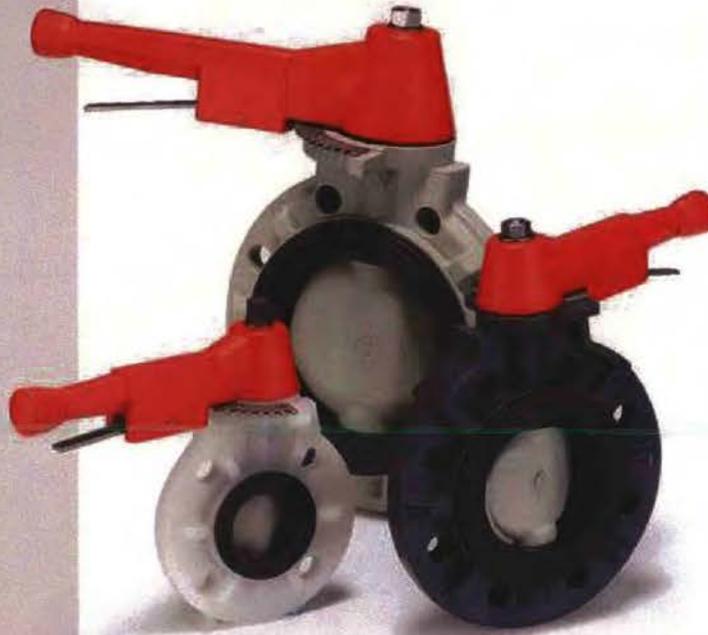
†These ranges calibrated for vertical scale position.
 * Accuracy +/-3%. ** Accuracy +/-4%

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APPENDIX 7



BUTTERFLY VALVE Lever handle type



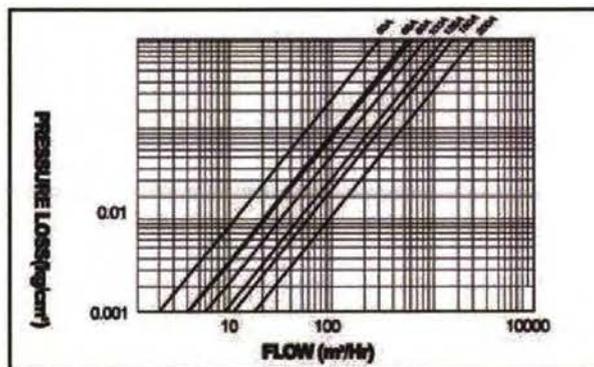
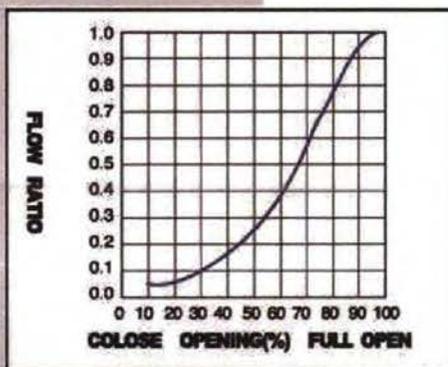
BB Series

旋轉凡而 (手把式)

BB300

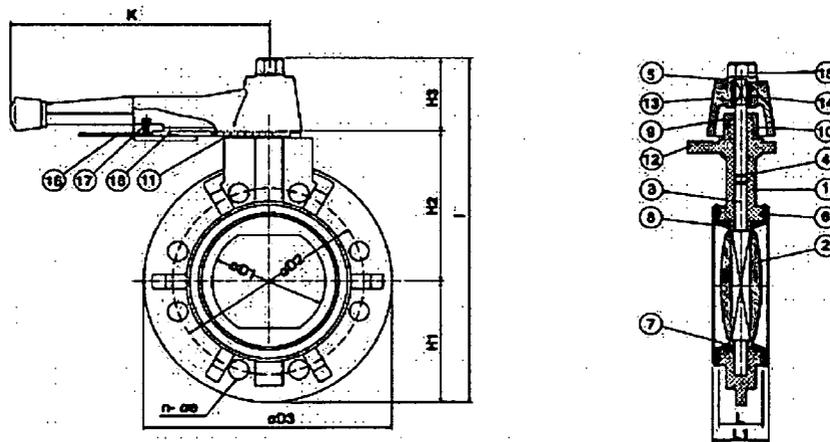
Size: 2"- 8"

options: 8"(DN200) GEAR OPERATOR TYPE



MATERIALS OF CONSTRUCTION

No.	Parts	Pcs.	Materials	No.	Parts	Pcs.	Materials
1	Body	1	UPVC,PP,PPG,PVDF,CPVC	10	Restainer Cap	1	UPVC,PP,PVDF
2	Disc	1	UPVC,PP,PPG,PVDF,CPVC	11	Positioner	1	SUS304
3	Stem	1	SUS410,SUS316,SUS304	12	Screw	3 DN200-200 2 DN250	SUS304
4	Stem O-ring	2	EPDM,VITON	13	Handle	1	ABS
5	Washer	1	SUS304	14	Inserted Metal Of Handle	1	FC0208
6	Seat	1	EPDM,VITON,NBR, HYPALON	15	Nut	1	PVC COATED BRASS,SUS304
7	Disc O'ring(1)	2	EPDM,VITON	16	Handle Lever	1	SUS304
8	Disc O'ring(2)	2	EPDM,VITON	17	Spring	1	SUS304
9	Stem Retainer	1	SUS304	18	Set Pin	1	BSBM



DN50-DN200

© TORQUE VALUES (1kgf/m=9.8N.m)

BFVS Size	Torque Under Without Any Water Pressure (Kg/cm ²)	Under Water Testing Pressure (Kg/cm ²)			BFVS Size	Torque Under Without Any Water Pressure (Kg/cm ²)	Under Water Testing Pressure (Kg/cm ²)		
		Water Pressure (Kg/cm ²)	Open Torque (Kg/cm ²)	Close Torque (Kg/cm ²)			Water Pressure (Kg/cm ²)	Open Torque (Kg/cm ²)	Close Torque (Kg/cm ²)
2"	1.5	15	0.5	0.5	10"	17.0	8	7	10
2-1/2"	1.5	15	0.5	0.5	12"	27.0	8	14	18
3"	2.0	15	1	1.5	14"	37.0	6	25	28
4"	2.0	12	1	1.5	16"	42.0	-	-	-
5"	5.0	12	2.5	4.5	18"	52.0	-	-	-
6"	6.5	12	4	7	20"	65.0	-	-	-
8"	10.0	10	6	8.5	24"	76.0	-	-	-

© DIMENSIONS TABLE

Nom. Size DN(Inch)	JIS												Unit: mm		
	D1	D2	D3	øe	n	L	L1	H1	H2	H3	I	K	Test Press (kgf/cm ²) Body	Working Press (kgf/cm ²) Seat	
50(2")	57	120	160	18	4	35	42	83	102	68	253	220	15.0	12.0	10.0
65(2 1/2")	72	140	184	18	4	37	46	92	110	68	270	220	15.0	12.0	10.0
80(3")	80	150	200	18	8	37	46	100	118	68	288	220	15.0	12.0	10.0
100(4")	100	175	230	18	8	47	56	115	134	68	312	220	15.0	12.0	10.0
125(5")	130	210	250	23	8	57	66	127	160	98	391	310	15.0	12.0	10.0
150(6")	150	240	290	23	8	62	71	146	177	98	418	310	15.0	12.0	10.0
200(8")	203	290	337	23	12	76	87	168	204	93	476	414	15.0	12.0	10.0

Nom. Size DN(Inch)	ANSI												Unit: Inch		
	D1	D2	D3	øe	n	L	L1	H1	H2	H3	I	K	Test Press (kgf/cm ²) Body	Working Press (kgf/cm ²) Seat	
50(2")	2.24	4.75	6.29	0.75	4	1.38	1.65	3.27	4.01	2.68	9.96	8.66	222	177	150
65(2 1/2")	2.83	5.50	7.24	0.75	4	1.48	1.81	3.62	4.33	2.68	10.63	9.68	222	177	150
80(3")	3.15	6.00	7.87	0.75	4	1.48	1.81	3.94	4.84	2.68	11.26	9.68	222	177	150
100(4")	3.93	7.50	9.06	0.75	8	1.85	2.20	4.53	5.28	2.68	124.8	9.68	222	177	150
125(5")	5.12	8.50	9.84	0.87	8	2.24	2.60	5.00	6.30	3.78	15	12.20	222	177	150
150(6")	5.90	9.50	11.42	0.87	8	2.44	2.60	5.71	6.97	3.78	18.76	12.20	222	177	150
200(8")	7.99	11.75	13.27	0.87	8	2.99	3.43	6.61	8.03	3.66	18.74	16.30	222	177	150

Nom. Size DN(Inch)	DIN												Unit: mm		
	D1	D2	D3	øe	n	L	L1	H1	H2	H3	I	K	Test Press (kgf/cm ²) Body	Working Press (kgf/cm ²) Seat	
50(2")	57	125	160	18	4	35	42	83	102	68	253	220	15.0	12.0	10.0
65(2 1/2")	72	145	184	18	4	37	46	92	110	68	270	220	15.0	12.0	10.0
80(3")	80	160	200	18	8	37	46	100	118	68	288	220	15.0	12.0	10.0
100(4")	100	180	230	18	8	47	56	115	134	68	312	220	15.0	12.0	10.0
125(5")	130	210	250	18	8	57	66	127	160	98	391	310	15.0	12.0	10.0
150(6")	150	240	290	23	8	62	71	145	177	98	418	310	15.0	12.0	10.0
200(8")	203	295	337	23	8	76	87	168	204	93	476	414	15.0	12.0	10.0

※ Standard dimensions based on PVC material

APPENDIX 8

WL

Low Flow/Full Cone

DESIGN FEATURES

- Advanced whirl plate design produces extremely uniform coverage
- Male and female connections

SPRAY CHARACTERISTICS

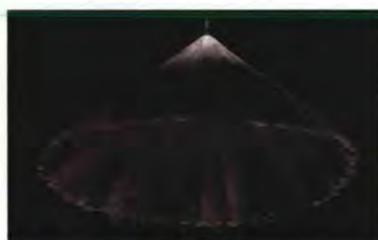
- Medium to coarse atomization
- Spray pattern:** Full Cone. Square pattern available
- Spray angles:** 30°, 60°, 90°, and 120° standard
- Flow rates:** 0.497 to 192 l/min



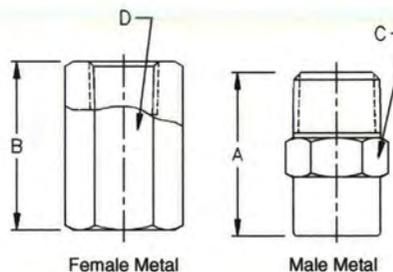
Metal



Full Cone 90°



Full Cone 120°



Dimensions are approximate. Check with BETE for critical dimension applications.

WL Flow Rates and Dimensions

Full Cone, 30°, 60°, 90° and 120° Spray Angles, BSP or NPT

Male or Female Pipe Size	Nozzle Number	K Factor	LITERS PER MINUTE @ BAR								Approx. Orifice Dia. (mm)	Dimensions for Metal Only (mm)				Wt. (g) Metal Plas.	
			0.7 bar	1 bar	2 bar	3 bar	5 bar	10 bar	15 bar	20 bar		A	B	C	D		
1/8	WL 1/4	0.587	0.497	0.587	0.814	0.984	1.25	1.73	2.10	2.40	1.09	22.2	28.6	11.1	14.3	28.4	7.1
	WL 1/2	1.17	0.993	1.17	1.63	1.97	2.50	3.47	4.19	4.80	1.40						
	WL 3/4	1.76	1.49	1.76	2.44	2.95	3.75	5.20	6.29	7.20	1.83						
1/4	WL 1	2.35	1.99	2.35	3.25	3.94	5.01	6.93	8.39	9.60	2.08	27.0	34.9	14.2	17.5	42.5	10.6
	WL 1 1/2	3.52	2.98	3.52	4.88	5.91	7.51	10.4	12.6	14.4	2.77						
3/8	WL 2	4.70	3.97	4.70	6.51	7.87	10.0	13.9	16.8	19.2	3.18	31.8	38.1	17.5	22.2	56.7	14.2
	WL 3	7.05	5.96	7.05	9.76	11.8	15.0	20.8	25.2	28.8	3.96						
	WL 4	9.40	7.95	9.40	13.0	15.7	20.0	27.7	33.6	38.4	4.78						
1/2	WL 5	11.7	9.93	11.7	16.3	19.7	25.0	34.7	41.9	48.0	5.16	38.1	50.8	22.2	28.6	85.1	28.4
	WL 6	14.1	11.9	14.1	19.5	23.6	30.0	41.6	50.3	57.6	5.56						
	WL 7	16.4	13.9	16.4	22.8	27.6	35.0	48.5	58.7	67.2	5.79						
3/4	WL 8	18.8	15.9	18.8	26.0	31.5	40.0	55.5	67.1	76.8	5.94	44.5	54.0	28.6	34.9	170	42.5
	WL 10	23.5	19.9	23.5	32.5	39.4	50.1	69.3	83.9	96.0	7.14						
	WL 12	28.2	23.8	28.2	39.0	47.2	60.1	83.2	101	115	7.92						
1	WL 15	35.2	29.8	35.2	48.8	59.1	75.1	104	126	144	8.33	55.6	60.3	34.9	41.3	397	99.2
	WL 20	47.0	39.7	47.0	65.1	78.7	100	139	168	192	9.53						

$$\text{Flow Rate (l/min)} = K (\text{bar})^{0.47}$$

Standard Materials: Brass, 303 Stainless Steel, 316 Stainless Steel, PVC, Polypropylene and PTFE (1/8" PTFE and Polypropylene not available in 120°).

Spray angle performance varies with pressure. Contact BETE for specific data on critical applications.

www.BETE.com

WHIRL

TO ORDER: specify pipe size, connection type, nozzle number, spray angle, and material.

APPENDIX 9

PROCESS SYSTEMS

AIR and FLUID CONTROL

2 WAY SOFT CLOSE SOLENOID VALVE

Normally Closed G1/4" - G2"

Normally Open G1/2" - G2"

Brass Body and Stainless Steel Body

'Econo' Series

Series

B35

B36

S35

'Econo' Series

General Description

An economical general purpose industrial solenoid valve with encapsulated coil.

The soft close function helps reduces water hammer and is suitable for non aggressive media up to 40 CST viscosity.

Typical applications include:

Mechanical Services, Fluid Control, Irrigation, Air, Inert Gases and Light Oils.

Technical Specifications

Fluid temperature: -10°C to 80°C

Materials in contact: Body - Brass or Stainless Steel

Shading Ring: Copper

Operator: Stainless Steel

Seat: Nitrile NBR

Backing Washer: POM

Voltage variation: +10% -10% AC/DC

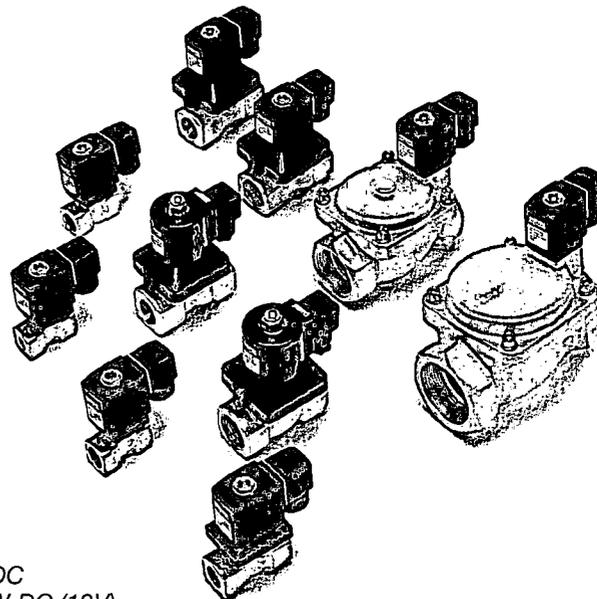
Duty rate: 100% (class F insulation)

Power: Sizes 1/4" to 1" - 11VA AC, 15W DC
 Sizes 1 1/4" to 2" - 20VA AC, 21W DC (12V)
 17W DC (24V)

Connector: Square Plug

Protection: IP65

Ambient temp: -10°C to +45°C



MODEL 'Econo'	FUNCTION	PORT SIZE- BSP	ORIFICE Ømm	CV	PRESSURE (BAR)		MEDIA TEMP (Nitrile)	WEIGHT kg
					AC	DC		

SERVO ASSISTED DIAPHRAGM VALVE - BRASS BODY - NORMALLY CLOSED (N.C)

B35 - 2-10 - * N	N.C	1/4	10	2.3	0.3-10	0.3-10 #	-10°C	0.5
B35 - 3-10 - * N		3/8	10	2.3	0.3-10	0.3-10 #		0.5
B35 - 4-10 - * N		1/2	10	3	0.3-10	0.3-10 #		0.5
B35 - 4-14 - * N		1/2	14	5	0.3-10	0.3-10 #		0.7
B35 - 5-14 - * N		3/4	14	5	0.3-10	0.3-10 #		1.4
B35 - 5-20 - * N		3/4	20	10	0.3-16	0.3-16		1.3
B35 - 6-20 - * N		1	20	11	0.3-16	0.3-16		1.3
B35 - 7-40 - * N		1 1/4	40	28	0.7-16	0.7-16		2.9
B35 - 8-40 - * N		1 1/2	40	34	0.7-16	0.7-16		2.8
B35 - 9-50 - * N	N.C.	2	50	50	0.7-16	0.7-16	80°C	4.2

SERVO ASSISTED DIAPHRAGM VALVE - BRASS BODY - NORMALLY OPEN (N.O)

B36 - 4 - 14 - * N	N.O	1/2	14	5	0.3-10	0.3-10 #	-10°C	0.7
B36 - 5 - 20 - * N		3/4	20	10	0.3-16	0.3-16		1.3
B36 - 6 - 20 - * N		1	20	11	0.3-16	0.3-16		1.3
B36 - 7 - 40 - * N		1 1/4	40	28	0.7-16	0.7-16		2.1
B36 - 8 - 40 - * N		1 1/2	40	34	0.7-16	0.7-16		2.8
B36 - 9 - 50 - * N	N.O.	2	50	50	0.7-16	0.7-16	80°C	4.2

SERVO ASSISTED DIAPHRAGM VALVE - ST.ST. BODY - NORMALLY CLOSED (N.C)

S35 - 2-10 - * N	N.C	1/4	10	2.3	0.3-10	0.3-10 #	-10°C	0.45
S35 - 3-10 - * N		3/8	10	2.3	0.3-10	0.3-10 #		0.45
S35 - 4-10 - * N		1/2	10	3	0.3-10	0.3-10 #		0.45
S35 - 5-20 - * N		3/4	20	10	0-10	0-10		1.4
S35 - 6-20 - * N	N.C	1	20	11	0-10	0-10	80°C	1.3

IMPORTANT - Chemical Resistance:

For specific information on chemical resistance of valve components to various Liquids and Gases, refer to the manufacturer or your distributor.

See overpage for applications warning. It is the responsibility of the user to determine suitability of the seat and body materials to the application.

= 12vDC & 24vAC
 = 0.3-7 Bar

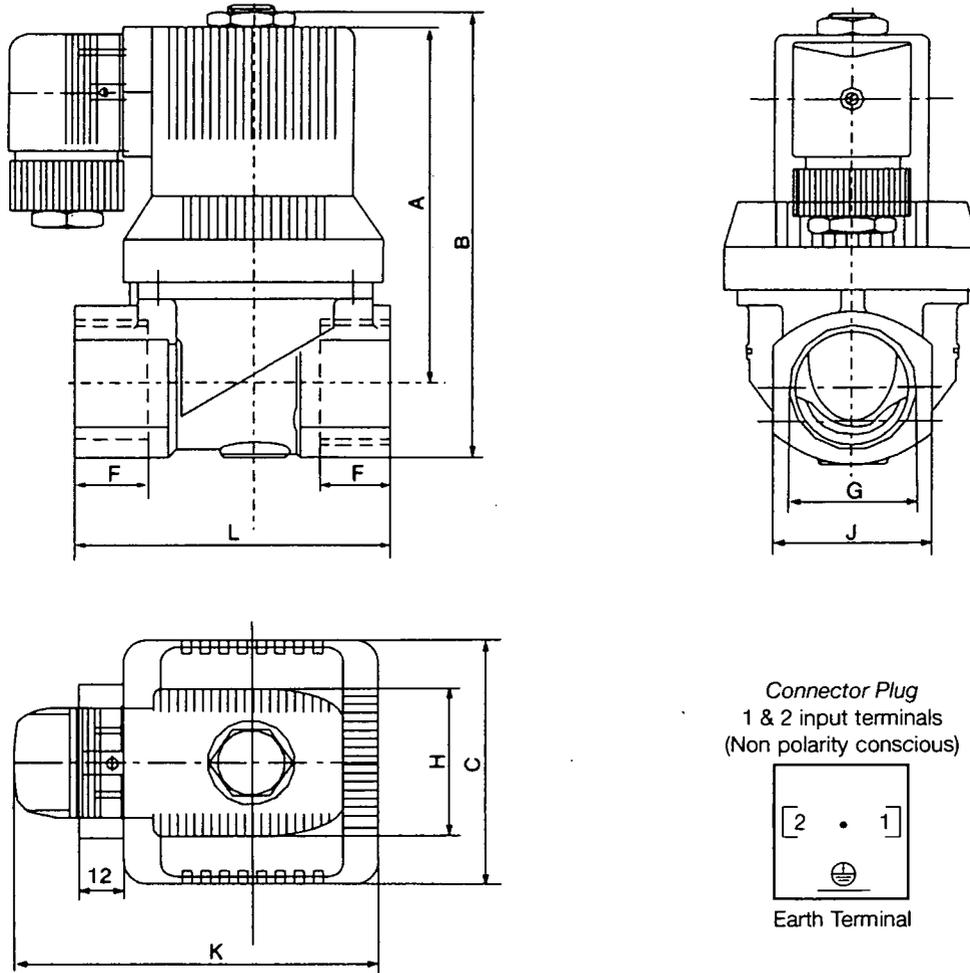
Ordering Example: B35-4-10-IN 1/2"BSP, 2 way N.C., 0.3-10 Bar,
 10mm orifice, NBR diaphragm, 240v AC c/w connector plug.



'Econo'
Series
B35 / B36 / S35

ECONOMICAL / HIGH FLOW / SOFT CLOSE / SOLENOID VALVE

Dimensions



MODEL	G	C	F	L	J	A	B	H	K
B35/S35-2-10	G1/4	38	14	50	26	71	85	35	80
B35/S35-3-10	G3/8	38	14	50	26	71	85		
B35/S35-4-10	G1/2	38	14	50	26	71	85		
B35/B36-4-14	G1/2	45	16	58	31	82	96		
B35-5-14	G3/4	45	16	58	31	82	96		
B35/B36/S35-5-20	G3/4	65	18	82	41	96	117		
B35/B36/S35-6-20	G1	65	18	82	41	96	117		
B35/B36-7-40	G1 1/4	96	20	132	58	112	145		
B35/B36-8-40	G1 1/2	96	20	132	58	112	145		
B35/B36-9-50	G2	111	22	160	70	125	166		

This data sheet can be downloaded from our website.

PROCESS SYSTEMS PTY LTD

A.B.N. 15 010 932 386

Email: sales@processsystems.com.au
P.O. Box 2070 Wellington Pt. Qld. 4160
Corner Lytton & Ramsay Rd. Hemmant, Brisbane
Queensland 4174 Australia

Website: www.valvesonline.com.au
Int. Fax +61 7 3890 3133
Phone 1300 887 880 (6 lines)
Int. Phone: +61 7 3890 3122

WARNING

These products are intended for use in industrial applications only. Do not use these products where pressures and temperatures can exceed those listed under 'Technical Data' and in our individual 'Series' data sheets. Before using these products with fluids other than those specified, for non-industrial applications, life-support systems, or other applications not within published specifications, consult Process Systems Pty Ltd.
Through misuse, age, or malfunction, components used in industrial valve applications can fail in various modes. The system designer is warned to consider the failure modes of all component parts used in industrial valve applications and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure.
System designers must provide a warning to the user in the system instructional manual if protection against a failure mode cannot be adequately provided.
System designers and end users are cautioned to review specific warnings or specifications found in instruction sheets or labels packed or attached and shipped with the products.
Our policy is one of continuous research and development. We therefore reserve the right to amend without notice the specifications given in this document or our individual 'Series' data sheets.

WARRANTY INFORMATION

Series B35/B36/S35 and all other products manufactured or distributed by Process Systems Pty. Ltd. are warranted by Process Systems to be free of defects in material and workmanship for a period of 1 year from the date of purchase or as the manufacturer warrants. Process Systems obligation under this warranty is limited to repair or replacement of the defective product or refund of the purchase price paid solely at the discretion of Process Systems and provided such defective product is returned to Process Systems freight prepaid and upon examination by Process Systems such product is found defective. This warranty shall be void in the event that the product has been subject to misuse, misapplication, improper maintenance, modification or tampering. This warranty is expressed in lieu of all other warranties, expressed or implied from Process Systems Pty. Ltd. representatives or employees. Process Systems reserves the right to change Valve and Brochure specifications without notice.

01/05

APPENDIX 10

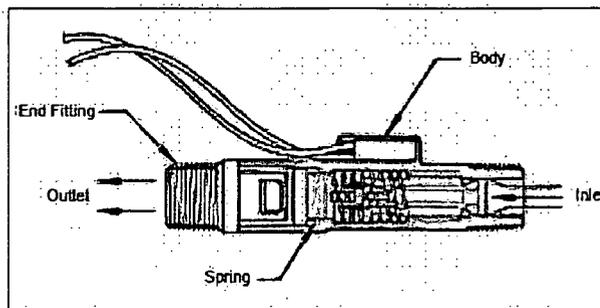


Instruction Bulletin No. 198938
Rev A

In-Line Flow Switches FS-380P Series

Installation

All NPT threads should be installed using a suitable thread sealant (Teflon tape or Permatex "No more Leaks"). Sealant must be kept out of unit during installation. Ten diameters of straight run piping are recommended upstream and downstream of the flow sensor.

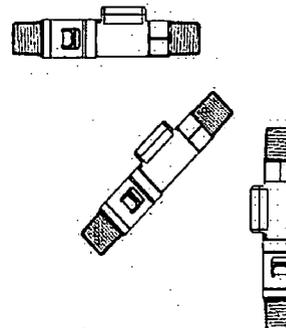


Specifications

Wetted Materials	
Housing, End-Fitting	Hydrolytically Stable Glass Reinforced Polypropylene
Piston	PPS Composite
Spring	316 Stainless Steel
O-Ring	
Fluorocarbon	
Oper. Pressure, Max.	200 PSI at 70°F, 100 PSI at 212°F
Operating Temperature	-20°F to +212°F (100°C)
Required Filtration	100 Micron or Better
Set Point Accuracy	±20%, Maximum
Set Point Differential	20% Maximum
Switch; See "Switch Ratings"	SPST, 10 VA
Inlet / Outlet	3/8" NPT Male or Quick Connect
Electrical Termination	No. 24 AWG, 24" to 26" Polymeric Leads

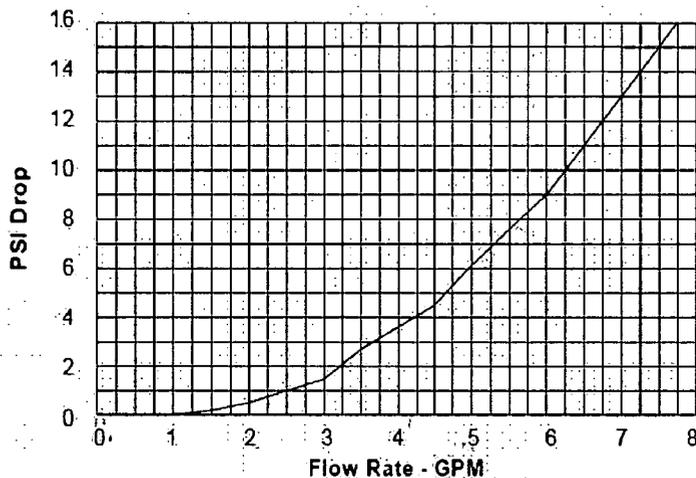
FS-380P Flow Switches Can be Mounted In Various Positions

Flow settings are based on a vertical position (inlet port down), using water at +70°F on increasing flow. Some variation in set point actuation will occur in other mounting orientations.



Note: The FS-380P is UL and CSA approved.

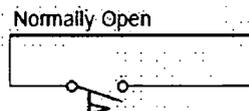
Pressure Drop - Typical



Switch Ratings

Contact rating: 10W
Switching Voltage (DC or AC Peak): 200 Max.
Switching Current (DC or AC): 0.4 A Max.
Carry Current (DC or AC): 0.4 A Max.
Break down Voltage: 230 VDC Min.

Wiring Diagram



Dimensions

3/8" NPT Ports

Quick Disconnect Ports

Important Points:

- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems product instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosionproof enclosure or intrinsically safe interface device.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applications according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

CE This product is suitable for Class I and Class II applications only, per the requirements of standard EN60730 and any additional specific requirements for a particular application or medium being sensed. Class I compliance of metal bodied units requires a ground connection between the metal body and the earthing system of the installation. Class I compliance of plastic bodied units in contact with a conductive medium requires that the medium be effectively earthed so as to provide an earthed barrier between the unit and accessible areas. For Class III compliance, a supply at safety extra-low voltage (SELV) must be provided. Please consult the Factory for compliance information on specific part numbers.

Return Policy

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Return the goods - freight prepaid - in the original container and include original packing slip. C. O. D. returns are not accepted. Gems reserves the right to apply restocking charges.

Tel: 860-793-4357
 Fax: 860-793-4563



Gems Sensors Inc.
 One Cowles Road
 Plainville, CT 06062-1198
 Toll-Free: 1-800-378-1600

APPENDIX 11

efector300

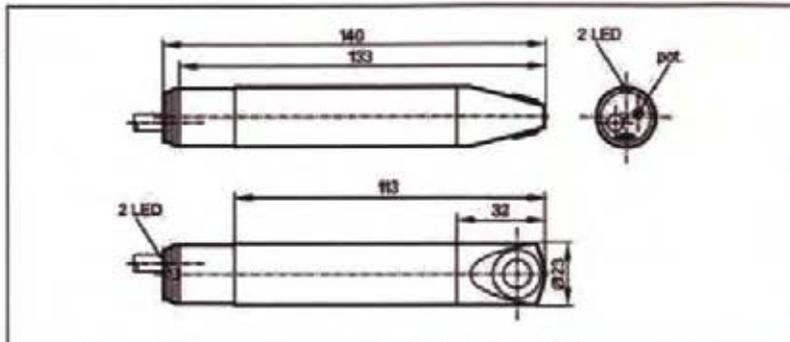


Flow sensors

SL5101

SLG23CEEAKOG
Airflow monitor
Cylindrical type
Cable

Process connection: Ø 23 mm

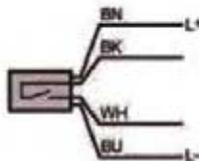


Made in Germany

Electrical design	DC
Output	relay energised when flow is present
Operating voltage [V]	24 DC ± 25 %
Contact rating	3 A (30 V DC / 250 V AC)
Power consumption [VA]	1
Max. temperature gradient of medium [K/min]	5
Pressure rating [bar]	1
Medium temperature [°C]	-10...50
Setting range [cm/s]	100...1000
Greatest sensitivity [cm/s]	100...400
Max. relative air humidity [%]	90
Adjustment of the switch point	with pot.
Power-on delay time [s]	60
Response time [s]	3...60
Ambient temperature [°C]	-10...50
Protection	IP 65
Housing materials	PBT (Pocan)
Materials (wetted parts)	sensor surface: titanium
Function display	1 x red / 1 x green
Connection	PUR / PVC cable / 2 m; 4 x 0.5 mm ²
Weight [kg]	0.189
Accessories (included)	Mounting clamp (E40048), screwdriver

Wiring

Core colours
 BN brown
 BU blue
 BK black
 WH white





Installation Instructions
Airflow monitor

efector30d
SLG

UK

701064 / 04 10 / 2007



1 Function and features

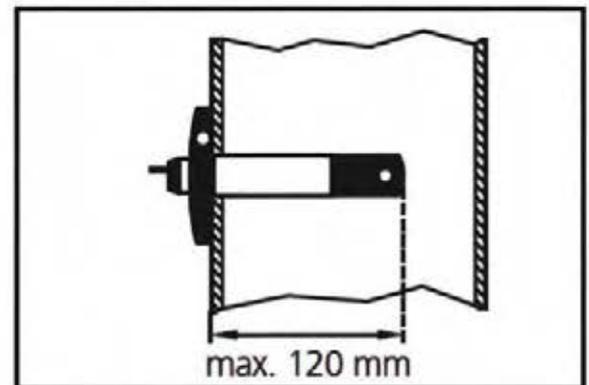
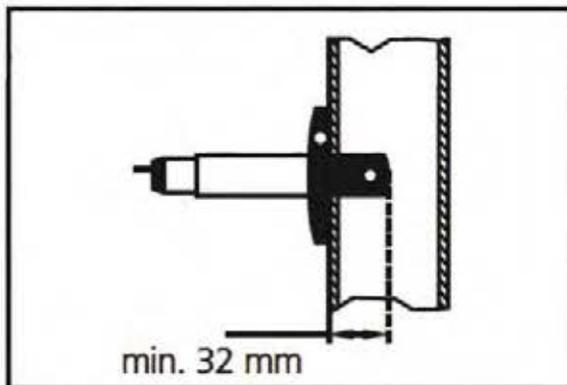
The airflow monitor monitors airflows. It senses whether there is a preset airflow (= green LED lights, output relay energised for NO function, de-energised for NC function).

If the flow is below the preset value, the red LED lights. The output relay is de-energised for NO function and energised for NC function.

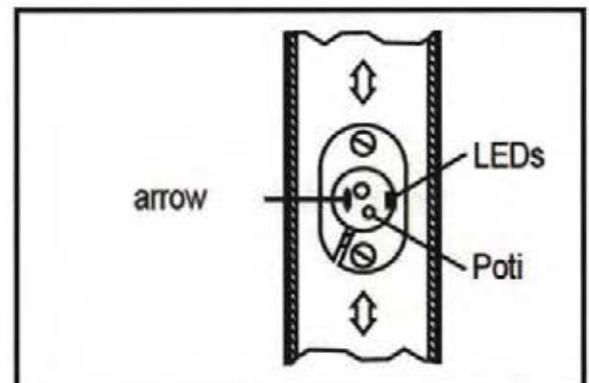
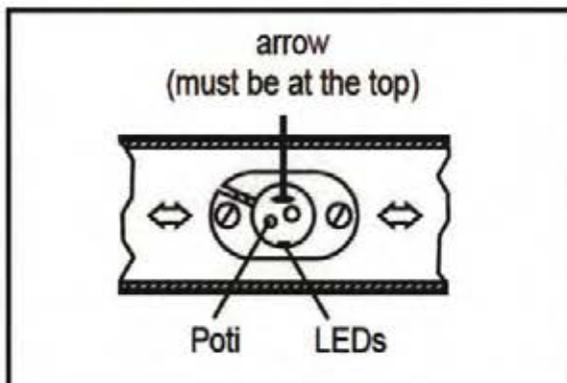
- Setting range 1 m/s to 10 m/s.
- Start-up delay of 3 s ... 60 s (to suppress short-time fluctuations), depending on the preset value

2 Mounting

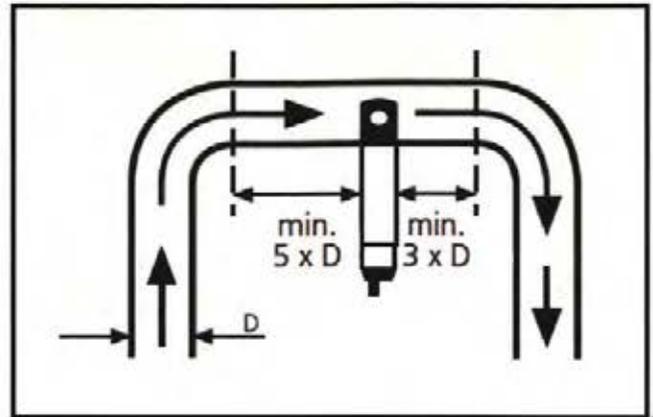
Mount the airflow monitor by means of the mounting clamp provided. Diameter of the mounting hole for the unit: 24 mm. If mounting is to be airtight, use the gasket provided. The sensing head must be completely immersed into the airflow and should be in the range of the highest flow velocity, if possible. Installation depth: min. 32 mm, max. 120 mm.



Align the unit in the airflow; the arrow on the cap must point in the direction of flow.



To avoid malfunction a minimum distance between the air flow monitor and bends, valves or such like must be observed.



UK

3 Electrical connection



The unit must only be connected by an electrician.

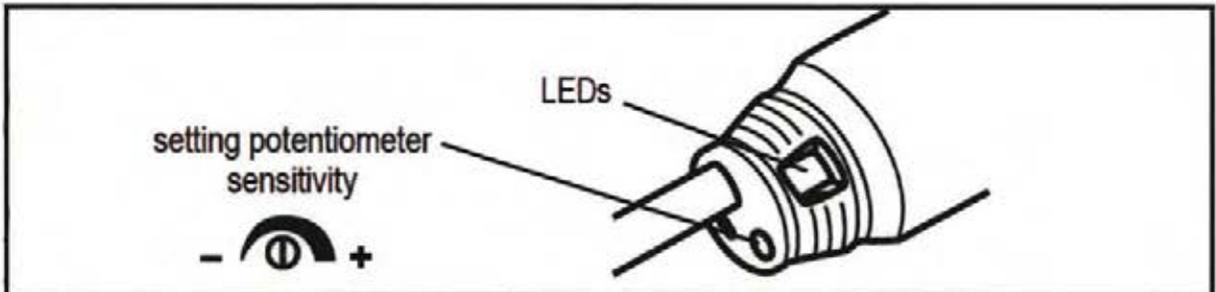
The national and international regulations for the installation of electrical equipment must be observed.

Voltage supply for units up to 60 V to EN50178, SELV, PELV.

Insert a miniature fuse according to the technical data sheet, if specified.

- ▶ Disconnect power.
- ▶ Connect the unit according to the indications on the type label.

4 Justieren



1	▶ Apply the operating voltage. ▶ Switch on the flow (preset value) and keep it constant. → Both LEDs (red and green) light; after approx. 60s one LED goes off.	
2	If the red LED lights: ▶ turn the pot slowly clockwise until the red LED goes off and the green LED comes on.	If the green LED lights: ▶ turn the pot slowly anticlockwise until the green LED goes off and the red LED comes on. ▶ Turn the pot again slowly clockwise until the green LED comes on.
3	If fluctuations as a result of the operating conditions are to be compensated for: ▶ turn the pot further clockwise after the green LED has lit.	

After application of the supply voltage both LEDs light for about 60 s, the output relay is energised (power-on delay time). The unit then is ready for operation.

APPENDIX 12


FL-FC
Flussimetri ad area variabile

Misuratori di portata a galleggianti, basati sul principio dell'area variabile.

Versioni per fluidi liquidi o per fluidi gassosi, con scale in l/h e m³/h. Scale speciali sono fornibili su richiesta.

Versione standard con tubo in Trogamid e galleggiante in acciaio inox o PVDF, con attacchi in PVC-U. A richiesta sono disponibili versioni con tubo, galleggiante ed attacchi in altri materiali, adatti a particolari fluidi e condizioni di esercizio (vedasi pag. seguenti).

I flussimetri sono dotati di riferimenti di minima e massima portata regolabili.

La portata può essere letta direttamente sulla scala, in corrispondenza dello spigolo superiore del corpo galleggiante.

Sul flussimetro possono essere montati microinterruttori di minima o massima o trasmettitori di segnale.

Per l'uso di questi accessori elettrici è necessario che il flussimetro sia dotato di galleggiante magnetico.

INSTALLAZIONE

Quando il flussimetro viene usato in sistemi comprendenti valvole di controllo, occorre seguire i seguenti criteri:

- se il fluido è liquido la valvola può essere installata indifferenzialmente a monte o a valle del flussimetro;
- se il fluido è gassoso la valvola può essere installata solo a valle del flussimetro;
- poiché il corpo galleggiante è molto sensibile alle variazioni di portata, si raccomanda di eseguire ogni manovra delle valvole con gradualità.

Variable area Flowmeters

These flowmeters are variable area measuring instruments, providing inexpensive and accurate measurement of flow rates for liquids and gases.

Versions for liquids and gases are available, with scales in l/h and m³/h.

Special scales are available on request.

The standard version is equipped with a Trogamid tube, U-PVC unions, and Stainless Steel or PVDF floater.

Other tubes, floaters and connection materials are available for special fluids and special working conditions (see following pages)

All flowmeters are fitted with maximum set points which are fully adjustable.

One can directly read the flow rate on the scale, at the level of the upper extremity of the floater.

In addition to the visual indicators, the flowmeters may be fitted with minimum - maximum switches or with a transmitter.

When fitting electrical accessories please make sure that a magnetic floater is installed in the flowmeter.

INSTALLATION DETAILS

When the flowmeter is used in a system provided with control valves, the following criteria must be observed:

- when using the flowmeter on liquid media, isolating or control valves may be mounted upstream or downstream the flowmeter;
- when using the flowmeter on gaseous media it is recommended that the control valves are mounted downstream the flowmeter;
- all control valves must be open slowly and gradually, because of the high sensitivity of the floater to the flow rate variations.

Débitmètres à luidion

Les débitmètres fonctionnent selon le principe "à luidion", pour la mesure des courants de liquides et de gaz, avec échelles disponibles en l/h et m³/h.

Des échelles spéciales sont disponibles sur demande.

Le matériau de la version standard est Trogamid avec flotteurs en acier inoxydable ou PVDF et manchons en PVC-U.

Des versions particulières sont équipées avec autres matériaux du tube, du flotteur et des manchons. Tous les débitmètres sont équipés avec références de Min et Max débit.

Le débit est indiqué sur l'échelle en correspondance de l'extrémité supérieure du flotteur.

Des contacts min ou max, ainsi qu'un détecteur pour lecture continue, peuvent être montés sur la queue d'aronde moulée sur chaque face.

Si on utilise des accessoires électriques, le flotteur doit être magnétique.

INSTALLATION

Quand le débitmètre est utilisé avec une vanne de contrôle, il faut observer les impératifs suivants:

- dans le cas d'utilisation pour des liquides, la vanne peut être montée avant ou après le débitmètre
- dans le cas d'utilisation pour des gaz, la vanne doit être montée après le débitmètre
- le flotteur du débitmètre est très sensible à tout changement de débit, toutefois les vannes doivent être réglées. Donc les manoeuvres doivent être graduelles.

Schwebekörper - Meßprinzip Durchflußmesser Typ ...785...-...790..

Mengenmeßgeräte nach dem Schwebekörper-Meßprinzip für preiswerte und genaue Durchflußmessungen.

Schwebekörper-Durchflußmesser eignen sich zur Mengemessung von durchsichtigen, flüssigen und gasförmigen Medien in geschlossenen Rohrleitungssystemen.

Das FIP-Programm enthält 2 Baureihen mit unterschiedlichen Baulängen und Genauigkeitsklassen. Die Geräte bestehen aus 3 Baugruppen, dem Kunststoffmeßkonus, dem Schwebekörper und den Anschlußteilen.

Die Durchflußmenge wird direkt durch den Schwebekörper auf der am Meßkonus angebrachten Skala angezeigt (l/h oder m³/h). Dabei bildet der größte Durchmesser des Schwebekörpers die Ablesekante.

Alle Durchflußmesser können zusätzlich mit Kontaktschaltern (Grenzwertgeber) ausgerüstet werden und sind damit auch zur Durchflußüberwachung einsetzbar. Die Schwebekörper müssen in diesen Fällen mit Magneten ausgerüstet sein.

Die Schaltpunkte können zwischen ca. 15 und 100% des jeweiligen Meßbereichs liegen.

EINBAU

Der Einbau hat spannungsfrei mit der Durchflußrichtung von unten nach oben zu erfolgen.

- Bei Flüssigkeiten können Regelorgane (Ventile) sowohl vor als auch hinter dem Meßgerät eingebaut werden.
- Bei Gasen ist zur Vermeidung von Kompressionsschwingungen der Einbau von Ventilen nur hinter dem Meßgerät zu empfehlen.
- Schwebekörper Durchflußmesser reagieren sehr empfindlich auf schnelle Durchflußänderungen. Regelorgane sind deshalb stets langsam zu betätigen.



LEGENDA

d	diametro nominale esterno del tubo in mm	d	nominal outside diameter of the pipe in mm	d	diamètre extérieur nominal du tube en mm	d	Rohraußendurchmesser in mm
DN	diametro nominale interno in mm	DN	nominal internal diameter in mm	DN	diamètre intérieur nominal du tube en mm PN	DN	Rohrinnenweite in mm
PN	pressione nominale in bar (pressione max di esercizio a 20°C in acqua)	PN	nominal pressure in bar (max. working pressure at 20°C - water)	PN	pression nominale en bar (pression de service max à 20°C- eau)	PN	Nennndruck; höchstzulässiger Betriebsdruck in bar, bei 20° C Wasser
pabs	pressione assoluta in bar	Pabs	absolute pressure in bar				
R	dimensione nominale della filettatura	R	nominal size of the thread	R	dimension nominale du filetage	R	Gewinde (DIN 2999, T1)
g	peso in grammi	g	weight in grams	g	poids en grammes	g	Gewicht in Gramm
γ	Densità in Kg/l	γ	density in Kg/l	γ	Densité en Kg/l	γ	Dichte, Kg/l
PVC-U	cloruro di polivinile rigido	U-PVC	unplasticized polyvinyl chloride	PVC-U	polychlorure de vinyle non plastifié	PVC-U	Polyvinylchlorid hart
PVC-C	cloruro di polivinile surclorato	PVC-C	chlorinated polyvinyl chloride	PVC-C	polychlorure de vinyle surchloré	PVC-C	Polyvinylchlorid nachchloriert
PVDF	polifluoruro di vinilidene	PVDF	polyvinylidene fluoride	PVDF	polyfluorure de vinylidène	PVDF	Polyvinylidenfluorid
EPDM	elastomero etilene propilene	EPDM	ethylene propylene rubber	EPDM	élastomère éthylène propylène	EPDM	Ethylenpropylen-dienelastomer
FPM	fluoroelastomero	FPM	vinylidene fluoride rubber	FPM	fluoroélastomère de vinylidène	FPM	Fluorelastomer
PA6	Trogamid-T	PA6	Trogamid-T	PA6	Trogamid-T	PA6	Trogamid-T, Polyamid
PSU	Polisulfone	PSU	Polysulfon	PSU	Polysulfon	PSU	Polysulfon (Polyarylethersulfon)
POM	resina poliacetalica	POM	polyoxymethylene	POM	résine polyacetal	POM	polyoxymethylen
Al	Alluminio	Al	Aluminium	Al	Aluminium	Al	Aluminium
HCL	acido cloridrico	HCL	hydrochloridric acid	HCL	acid chloridrique	HCL	Salzäure
NAOH	idrossido di sodio	NAOH	sodium hydroxide	NAOH	hydroxyde de sodium	NAOH	Natronlauge



FL-FC

Caratteristiche generali

General features

Caracteristiques generales

Generelle Merkmale

FL

Serie standard	d 20 - d 32 - d 63 R 1/2" - R1" - R 2"
Standard range	d 20 - d 32 - d 63 R 1/2" - R1" - R 2"
Serie standard	d 20 - d 32 - d 63 R 1/2" - R1" - R 2"
Standard Baureihe	d 20 - d 32 - d 63 R 1/2" - R1" - R 2"

FC

Serie compatta (lunghezza ridotta)	d 20 - d 32 R 1/2" - R 1"
Compact range (reduced length)	d 20 - d 32 R 1/2" - R 1"
Serie compacte (longueur reduit)	d 20 - d 32 R 1/2" - R 1"
Kompaktbaureihe (reduzierte Länge)	d 20 - d 32 R 1/2" - R 1"

TIPO DI FLUIDO - FLUID TYPE - TYPE DE FLUIDE - DURCHFLOSS-MEDIUM

	LIQUIDO - LIQUID- LIQUIDE - FLÜSSIG	ARIA - AIR - AIR - GASFORMIG
Materiale delle guarnizioni Sealing Material Materiaux des joints Dichtwerkstoff	EPDM - (FPM) EPDM - (FPM) EPDM - (FPM) EPDM - (FPM)	EPDM - (FPM) EPDM - (FPM) EPDM - (FPM) EPDM - (FPM)
Materiale del tubo Tube material Materiaux du tube Meßkonuswerkstoff	Trogamid-T / Polisulfone Trogamid-T / Polysulfon Trogamid-T / Polysulfon Trogamid-T / Polysulfon	Trogamid-T Trogamid-T Trogamid-T Trogamid-T
Materiale del galleggiante Floater material Materiaux du flotteur Swebekörper aus	Inox / PVDF appesantito / PVC-U+magnete PVDF+magnete / Inox+magnete Stainless steel / PVDF weighted / U-PVC+magnet PVDF+magnet / SS+magnet Inox / PVDF armé / PVC-U+magnete PVDF+magnet / Inox+magnet Edelstahl / PVDF beschwert / PVC-U+Magnet / PVDF+Magnet / Edelstahl+Magnet	PVC-U / Alluminio / PVC-U+magnete U-PVC / Aluminium / U-PVC+magnet PVC-U / Alluminio / PVC-U+magnete PVC-U / Aluminium / PVC-U+magnete
Attacchi (*) Connections (*) Raccordements (*) Anschlüsse (*)	Bocchettoni PVC-U per incollaggio (ISO-BS-ASTM) o filettati (BSP) Bocchettoni PVC-C per incollaggio (ISO-BS-ASTM)-Bocchettoni PP per saldatura nel bicchiere (ISO) U-PVC unions for socket welding (ISO-BS-ASTM) or threaded (BSP) C-PVC unions for socket welding (ISO-BS-ASTM)- PP unions for socket fusion (ISO) Manchons PVC-U à coller (ISO-BS-ASTM) ou taraudés Manchons PVC-C à coller (ISO-BS-ASTM)- Manchons PP à souder (ISO) PVC-U Klebemuffen (ISO-BS-ASTM) oder Gewindemuffen PVC-U Klebemuffen (ISO-BS-ASTM) - PP Klebemuffen (ISO)	

(*) Su richiesta sono disponibili bocchettoni metallici (acciaio zincato o inox) e versioni flangiate

(*) Metal unions (zincated steel or stainless steel) and flanged versions are available on request

(*) Raccordements manchons en metal (acier zingué ou acier inoxydable) et versions avec brides sont disponibles sur demande

(*) Metallverschraubungen (St. Verzinkt oder Edenstahl) un Flanschen sind auf Anfrage lieferbar





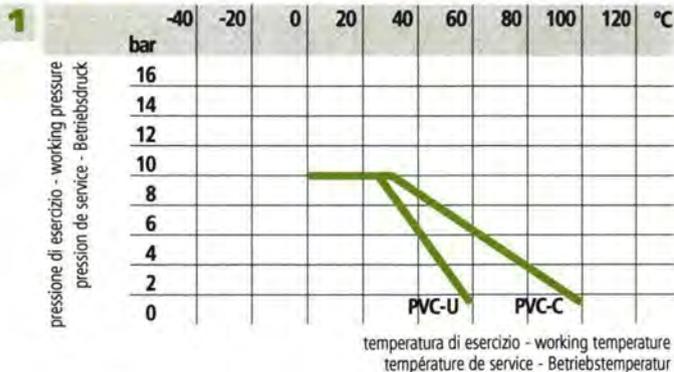
FL-FC

**Dati
Tecnici**

**Technical
Data**

**Données
Techniques**

**Technische
Daten**



	FL												FC								
Corpo del flussimetro N° Tube body N° Corps du débitmètre N° Meßrohr N°	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
Fluido liquido [m bar] Liquid fluid [m bar] Liquid fluide [m bar] Flüssigkeit [m bar]	11	13	17	17	20	24	25	27	32	51	65	91	10	10	10	12	12	17	17	17	20
Fluido gassoso (Aria) [m bar] Gaseous fluid (Air) [m bar] Fluide gazeous (Aire) [m bar] Gas - (Luft) [m bar]	4	5	7	7	7	8	9	10	13	23	31	43	4	4	4	5	5	7	7	7	7

	FL	FC
Classe di precisione Accuracy class Categorie de precision Genauigkeitsklasse	2.5	4
Incertezza di misura Accuracy Erreur de mesure Meßgenauigkeit	± 1.875% della misura ± 0.625% della scala ± 1.875% of the measure ± 0.625% of the scale ± 1.875% de la mesure ± 0.625% de l'échelle ± 1.875% vom Meßwert ± 0.625% vom Skalenendwert	± 3% della misura ± 1% della scala ± 3% of the measure ± 1% of the scale ± 3% de la mesure ± 1% de l'échelle ± 3% vom Meßwert ± 1% vom Skalenendwert

1 Variazione della pressione in funzione della temperatura per acqua o fluidi non pericolosi nei confronti dei quali il materiale è classificato CHIMICAMENTE RESISTENTE. In altri casi è richiesta un'adeguata diminuzione della pressione nominale PN. (25 anni con fattore di sicurezza).

Pressure/temperature rating for water and harmless fluids to which the material is RESISTANT. In other cases a reduction of the rated PN is required. (25 years with safety factor).

Variation de la pression en fonction de la température pour l'eau et les fluides non agressifs pour lequel le matériau est considéré CHIMIQUEMENT RESISTANT. Pour les autres cas une diminution du PN est nécessaire. (25 années avec facteur de sécurité inclus).

Druck/Temperatur-Diagramm für Wasser und ungefährliche Medien gegen die das Material BESTÄNDIG ist. In allen anderen Fällen ist eine entsprechende Reduzierung der Druckstufe erforderlich. (Unter Berücksichtigung des Sicherheitsfaktors für 25 Jahre).

2 Perdite di carico con galleggiante inox per liquidi e alluminio per aria

Pressure loss with stainless steel floater for liquids and aluminium floater for air.

Perte de charge avec flotteur en acier inoxydable pour liquides et aluminium pour air.

Druckverlust bei Schwebekörper aus Edelstahl für Flüssigkeiten und aus Aluminium für Luft.

3 Classe di precisione secondo VDI / VDE 3513, foglio 2

Accuracy Class according to: VDI / VDE 3513, folio 2

Categorie de precision selon: VDI / VDE 3513, feuille 2

Genauigkeitsklasse nach: VDI / VDE 3513, Blatt 2



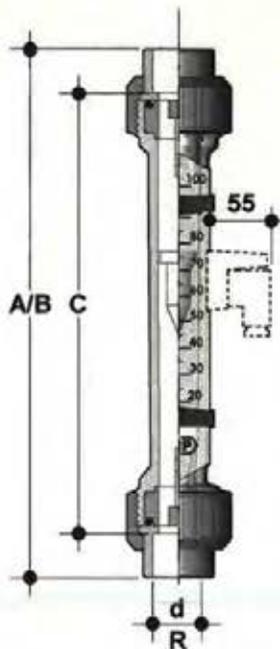
FL-FC

**Dati
Tecnici**

**Technical
Data**

**Données
Techniques**

**Technische
Daten**



	FL												FC								
Corpo del flussimetro N° Tube body N° Corps du débitmètre N° Meßrohr N°	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
*Filettati BSP R° *Threaded BSP R° *Taraudées BSP R° *Gewindemuffe BSP R°	1/2	1/2	1	1	1	1	2	2	2	2	2	2	1/2	1/2	1/2	1/2	1/2	1	1	1	1
*Incollaggio d [mm] *Socket cementing d [mm] *A collar d [mm] *Klebemuffe d [mm]	20	20	32	32	32	32	63	63	63	63	63	63	20	20	20	20	20	32	32	32	32
**Filettati BSP A ± 4 **Threaded BSP A ± 4 **Taraudées BSP A ± 4 **Gewindemuffe BSP A ± 4	349	349	358	358	358	358	376	376	376	376	376	376	207	207	207	207	207	252	252	252	252
**Incollaggio B ± 4 **Socket cementing B ± 4 **A collar B ± 4 **Klebemuffe B ± 4	342	342	354	354	354	354	386	386	386	386	386	386	203	203	203	203	203	250	250	250	250
**Incollaggio C ± 4 **Socket cementing C ± 4 **A collar C ± 4 **Klebemuffe C ± 4	310	310	310	310	310	310	310	310	310	310	310	310	171	171	171	171	171	206	206	206	206
Lunghezza del tubo Tube length Longueur du tube Meßrohrlänge	300	300	300	300	300	300	300	300	300	300	300	300	165	165	165	165	165	200	200	200	200
Peso Kg Weight Kg Poids Kg Gewicht Kg	0,4	0,4	0,7	0,7	0,7	0,7	2,2	2,2	2,2	2,2	2,2	2,2	0,15	0,15	0,15	0,15	0,15	0,35	0,35	0,35	0,35

** Dimensioni con gli attacchi
* Attacchi

** Dimensions including union ends
* Connections

** Dimensions avec embouts
* Embouts

** Abmessungen bei Einlegteilen
* Anschlüsse





FL-FC

Portate

Flow Rates

Débit

Meßbereiche

FL

	1	2	3	4	5	6	7	8	9	10	11	12	
Corpo del flussimetro N° Flowmeter Tube N° Corps du débitmètre N° Meßrohr N°	1	2	3	4	5	6	7	8	9	10	11	12	
Attacchi - Connections Embouts - Anschlüsse	Filettati BSP R" Threaded BSP R" Taraudées BSP R" Gewindemuffe BSP R"	1/2	1/2	1	1	1	1	2	2	2	2	2	
	Incollaggio d [mm] Socket cementing d [mm] A collar d [mm] Klebemuffe d [mm]	20	20	32	32	32	32	63	63	63	63	63	
LIQUIDI - LIQUIDS - LIQUIDES - FLÜSSIGKEITEN γ = 1 kg/l - 20 °C	Galleggiante inox Stainless steel floater Flotteur acier inox Swebekörper aus Edelmet. 1.4571	$\frac{12,5}{125}$	$\frac{31,5}{315}$	$\frac{65}{650}$	$\frac{100}{1000}$	$\frac{160}{1600}$	$\frac{250}{2500}$	$\frac{0,4}{4}$	$\frac{0,65}{6,5}$	$\frac{1}{10}$	$\frac{4}{16}$	$\frac{6}{20}$	$\frac{8}{25}$
	Galleggiante PVDF appesantito Floater PVDF weighted Flotteur PVDF armé Swebekörper PVDF beschwert	$\frac{6,5}{65}$	$\frac{17,5}{175}$	$\frac{50}{500}$	$\frac{75}{750}$	$\frac{125}{1250}$	$\frac{200}{2000}$	$\frac{0,32}{3,2}$	$\frac{0,5}{5}$	$\frac{0,75}{7,5}$	$\frac{4}{12,5}$	-	---
	Galleggiante inox + magnete Stainless steel floater+magnet Flotteur acier inox+magnet Swebek. Edelmet. 1.4571+Magnet	$\frac{12}{120}$	$\frac{30}{300}$	$\frac{60}{600}$	$\frac{95}{950}$	$\frac{150}{1500}$	$\frac{200}{2000}$	$\frac{0,38}{3,8}$	$\frac{0,64}{6,4}$	$\frac{0,95}{9,5}$	$\frac{4}{16}$	$\frac{6}{19}$	$\frac{8}{24}$
	Galleggiante PVDF + magnete Floater PVDF + magnet Flotteur PVDF + magnet Swebekörper PVDF + Magnet	$\frac{6,5}{65}$	$\frac{17,5}{175}$	$\frac{45}{450}$	$\frac{70}{700}$	$\frac{110}{1100}$	$\frac{175}{1750}$	$\frac{0,32}{3,2}$	$\frac{0,5}{5}$	$\frac{0,75}{7,5}$	$\frac{4}{12,5}$	-	-
NAOH 30%	Galleggiante inox Stainless steel floater Flotteur acier inox Swebekörper aus Edelmet. 1.4571	$\frac{8,5}{85}$	$\frac{20}{190}$	$\frac{40}{350}$	$\frac{50}{500}$	$\frac{100}{800}$	$\frac{120}{1200}$	$\frac{0,3}{2,1}$	$\frac{0,32}{3,2}$	$\frac{0,45}{4,5}$	-	-	-
	Galleggiante inox Stainless steel floater Flotteur acier inox Swebekörper aus Edelmet. 1.4571	$\frac{0,9}{16}$	$\frac{5}{65}$	$\frac{10}{150}$	$\frac{10}{300}$	$\frac{40}{600}$	$\frac{50}{1100}$	$\frac{0,15}{1,9}$	$\frac{0,3}{3}$	$\frac{0,4}{4,2}$	-	-	-
HCL 30-33%	Galleggiante PVDF appesantito Floater PVDF weighted Flotteur PVDF armé Swebekörper PVDF beschwert	$\frac{5}{55}$	$\frac{15}{150}$	$\frac{40}{420}$	$\frac{65}{650}$	$\frac{100}{1000}$	$\frac{160}{1700}$	$\frac{0,25}{2,8}$	$\frac{0,45}{4,5}$	$\frac{0,7}{7}$	-	-	-
	Galleggiante PVDF + magnete Floater PVDF + magnet Flotteur PVDF + magnet Swebekörper PVDF + Magnet	$\frac{3}{50}$	$\frac{10}{140}$	$\frac{40}{420}$	$\frac{60}{630}$	$\frac{100}{1000}$	$\frac{160}{1700}$	$\frac{0,25}{2,8}$	$\frac{0,45}{4,5}$	$\frac{0,5}{7}$	-	-	-
ARIA - AIR - AIR - LUFT pabs = 1.013 bar - 20 °C	Galleggiante PVC-U Floater U-PVC Flotteur PVC-U Swebekörper aus PVC-U	$\frac{0,14}{1,4}$	$\frac{0,34}{3,4}$	$\frac{0,7}{7}$	$\frac{1,1}{11}$	$\frac{1,8}{18}$	$\frac{2,8}{28}$	$\frac{4,5}{45}$	$\frac{7,5}{75}$	$\frac{12}{120}$	$\frac{45}{190}$	$\frac{75}{240}$	$\frac{100}{300}$
	Galleggiante Alluminio Floater Aluminium Flotteur Aluminium Swebekörper Aluminium	$\frac{0,2}{2}$	$\frac{0,5}{5}$	$\frac{1}{10}$	$\frac{1,6}{16}$	$\frac{2,5}{25}$	$\frac{4}{40}$	$\frac{6,4}{64}$	$\frac{10}{100}$	$\frac{16}{160}$	$\frac{70}{280}$	$\frac{110}{350}$	$\frac{140}{430}$
	Galleggiante PVC-U + magnete Floater U-PVC + magnet Flotteur PVC-U + magnet Swebekörper aus PVC-U + Magnet	$\frac{0,23}{2,3}$	$\frac{0,6}{6}$	$\frac{1}{10}$	$\frac{1,6}{16}$	$\frac{2,5}{25}$	$\frac{4}{40}$	$\frac{6}{60}$	$\frac{10}{100}$	$\frac{16}{160}$	-	-	-

$\frac{\text{min}}{\text{max}} = \text{l/h}$

$\frac{\text{min}}{\text{max}} = \text{m}^3/\text{h}$



FL-FC

Portate

Flow Rates

Débit

Meßbereiche

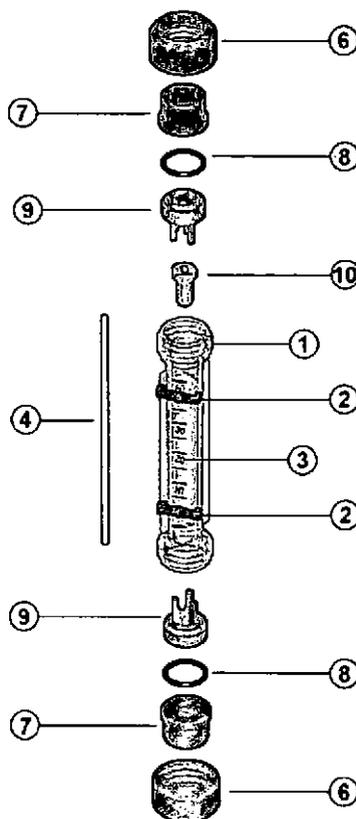
FC

		1	2	3	4	5	6	7	8	9
Corpo del flussimetro N° Flowmeter Tube N° Corps du débitmètre N° Meßrohr N°										
Attacchi - Connexions Embouts - Anschlüsse	Filettati BSP R" Threaded BSP R" Taraudées BSP R" Gewindemuffe BSP R"	1/2	1/2	1/2	1/2	1/2	1	1	1	1
	Incollaggio d [mm] Socket cementing d [mm] A collar d [mm] Klebemuffe d [mm]	20	20	20	20	20	32	32	32	32
	Galleggiante inox Stainless steel floater Flotteur acier inox Swebekorper aus Edilst. 1.4571	$\frac{4}{40}$	$\frac{6,5}{65}$	$\frac{10}{100}$	$\frac{16}{160}$	$\frac{25}{250}$	$\frac{40}{400}$	$\frac{65}{650}$	$\frac{100}{1000}$	$\frac{160}{1600}$
	Galleggiante PVDF appesantito Floater PVDF weighted Flotteur PVDF armé Swebekorper PVDF beschwert	$\frac{2}{20}$	$\frac{3,5}{35}$	$\frac{5,5}{55}$	$\frac{10}{100}$	$\frac{14}{140}$	$\frac{30}{300}$	$\frac{50}{500}$	$\frac{75}{750}$	$\frac{120}{1200}$
LIQUIDI - LIQUIDES - LIQUIDES - FLÜSSIGKEITEN γ = 1 kg/l - 20 °C	Galleggiante inox + magnete Stainless steel floater+magnet Flotteur acier inox+magnet Swebek. Edilst. 1.4571+Magnet	$\frac{4}{40}$	$\frac{6}{60}$	$\frac{9,5}{90}$	$\frac{16}{160}$	$\frac{24}{240}$	$\frac{40}{400}$	$\frac{65}{650}$	$\frac{100}{1000}$	$\frac{160}{1600}$
	Galleggiante PVDF + magnete Floater PVDF + magnet Flotteur PVDF + magnet Swebekorper PVDF + Magnet	$\frac{2}{20}$	$\frac{3,5}{35}$	$\frac{5,5}{55}$	$\frac{9}{90}$	$\frac{14}{140}$	$\frac{25}{250}$	$\frac{45}{450}$	$\frac{65}{650}$	$\frac{100}{1000}$
	Galleggiante inox Stainless steel floater Flotteur acier inox Swebekorper aus Edilst. 1.4571	$\frac{2}{30}$	$\frac{10}{45}$	$\frac{15}{70}$	$\frac{20}{110}$	$\frac{40}{160}$	$\frac{40}{200}$	$\frac{50}{340}$	$\frac{80}{500}$	$\frac{130}{840}$
	Galleggiante PVC-U + magnete Floater U-PVC + magnet Flotteur PVC-U + magnet Swebekorper PVC-U + Magnet	$\frac{0,3}{3}$	$\frac{0,3}{6,5}$	$\frac{0,5}{14}$	$\frac{1}{30}$	$\frac{2}{55}$	$\frac{5}{120}$	$\frac{10}{230}$	$\frac{15}{350}$	$\frac{30}{600}$
NAOH 30%	Galleggiante inox Stainless steel floater Flotteur acier inox Swebekorper aus Edilst. 1.4571	$\frac{0,3}{5}$	$\frac{1}{7}$	$\frac{2}{12}$	$\frac{3}{25}$	$\frac{5}{45}$	$\frac{5}{75}$	$\frac{10}{140}$	$\frac{20}{280}$	$\frac{30}{600}$
	Galleggiante PVC-U + magnete Floater U-PVC + magnet Flotteur PVC-U + magnet Swebekorper PVC-U + Magnet	$\frac{0,04}{0,4}$	$\frac{0,06}{0,6}$	$\frac{0,13}{1,3}$	$\frac{0,03}{3}$	$\frac{0,15}{6,5}$	$\frac{0,5}{19}$	$\frac{0,8}{40}$	$\frac{1,5}{75}$	$\frac{3}{160}$
	Galleggiante PVDF appesantito Floater PVDF weighted Flotteur PVDF armé Swebekorper PVDF beschwert	$\frac{1,6}{18}$	$\frac{2}{25}$	$\frac{4}{40}$	$\frac{7,5}{75}$	$\frac{12}{120}$	$\frac{25}{250}$	$\frac{45}{450}$	$\frac{65}{650}$	$\frac{100}{1000}$
HCL 30-33%	Galleggiante PVDF + magnete Floater PVDF + magnet Flotteur PVDF + magnet Swebekorper PVDF + Magnet	$\frac{1,5}{15}$	$\frac{2,5}{25}$	$\frac{4,5}{45}$	$\frac{7}{70}$	$\frac{11}{110}$	$\frac{20}{210}$	$\frac{38}{380}$	$\frac{55}{550}$	$\frac{85}{850}$
	Galleggiante PVC-U Floater U-PVC Flotteur PVC-U Swebekorper aus PVC-U	$\frac{55}{550}$	$\frac{70}{700}$	$\frac{100}{1000}$	$\frac{180}{1800}$	$\frac{300}{3000}$	$\frac{500}{5000}$	$\frac{0,8}{8}$	$\frac{1,2}{12}$	$\frac{2}{20}$
ARIA - AIR - AIR - LUFT pabs = 1.013 bar - 20 °C	Galleggiante Alluminio Floater Aluminium Flotteur Aluminium Swebekorper Aluminium	$\frac{100}{1000}$	$\frac{120}{1200}$	$\frac{180}{1800}$	$\frac{280}{2800}$	$\frac{400}{4000}$	$\frac{700}{7000}$	$\frac{1,2}{12}$	$\frac{1,7}{17}$	$\frac{2,5}{25}$
	Galleggiante PVC-U + magnete Floater U-PVC + magnet Flotteur PVC-U + magnet Swebekorper aus PVC-U + Magnet	$\frac{80}{800}$	$\frac{130}{1300}$	$\frac{200}{2000}$	$\frac{320}{3200}$	$\frac{500}{5000}$	$\frac{630}{6300}$	$\frac{1}{10}$	$\frac{1,6}{16}$	$\frac{2,5}{25}$

$\frac{\text{min}}{\text{max}} = \text{l/h}$

$\frac{\text{min}}{\text{max}} = \text{m}^3/\text{h}$





Pos.	Componenti	Materiale	Q.tà
1	tubo	Trogamid-T / PSU	1
2	indicatore	POM	2
3	scala	incollata o stampata sul tubo	1
4	guida (*)	acciaio inox	1
6	ghiera	PVC-U/PVC-C/PP	2
7	manicotto	PVC-U/PVC-C/PP	2
8	O-Ring	EPDM/FPM	2
9	supporto	PSU	(#)2
10	galleggiante	Inox/PVDF/PVC-U/Al	1

(*) solo per DN 50
(#) Q.tà 1 per FC

Pos.	Composants	Materiaux	Q.té
1	tube	Trogamid-T / PSU	1
2	indicateur	POM	2
3	échelle	à coller ou imprimée	1
4	guide (*)	acier inoxydable	1
6	manchon	PVC-U/PVC-C/PP	2
7	bouchon	PVC-U/PVC-C/PP	2
8	joint	EPDM/FPM	2
9	butée	PSU	(#)2
10	flotteur	Inox/PVDF/PVC-U/Al	1

(*) seulement pour DN 50
(#) Q.té 1 pour FC

Pos.	Components	Material	Q.ty
1	tube	Trogamid-T / PSU	1
2	set point indicator	POM	2
3	scale	label or tampoprint	1
4	guide rod (*)	stainless Steel	1
6	nut	U-PVC/PVC-C/PP	2
7	end connector	U-PVC/PVC-C/PP	2
8	O-Ring	EPDM/FPM	2
9	support	PSU	(#)2
10	floaters	Stainless St./PVDF/U-PVC/Al	1

(*) only for DN 50
(#) Q.ty 1 for FC

Pos.	Benennung	Werkstoff	Stück
1	Meßkonus	Trogamid-T / PSU	1
2	Sollwertanzeige	POM	2
3	Skala	Klebeskala/Printskala	1
4	Führungsstange (*)	Edelstahl	1
6	Überwurfmutter	PVC-U/PVC-C/PP	2
7	Einlegeteil	PVC-U/PVC-C/PP	2
8	O-Ring	EPDM/FPM	2
9	Anschlag	PSU	(#)2
10	Schwebekörper	Edelstahl/PVDF/PVC-U/Al	14

(*) nur bei DN 50
(#) Stück 1 bei FC



FL-FC

Accessori**Accessories****Accessoires****Zubehör****Microinterruttore**

Il microinterruttore bistabile 24.86 viene posizionato ad incastro sulla guida predisposta sul flussimetro. Al passaggio del corpo galleggiante magnetico viene attivato il contatto.

PECULIARITA'

- Funzionamento bistabile
- Elevata resistenza alle vibrazioni
- Assenza di effetti di ritorno
- Assenza di interferenze con eventuale secondo microinterruttore
- Inerzia praticamente nulla
- Protezione involucro: IP 65
- Facile connessione
- Disponibile versione con TRIAC

Micro-Switch

The bistable limit switch type 24.86 is clamped on the guide of the flow-meter. The reeving of the magnetic floater activates the contact.

CHARACTERISTICS

- Bistable operating mode
- High resistance to vibrations
- Total absence of feedback effects
- Total absence of interferences in relation to a supplementary limit switch
- Inertia reduced to a minimum
- Electrical protection: IP 65
- Easy connection
- A special version provided with TRIAC is available.

Microinterrupteur

Le microinterrupteur bi-stable 24.86 est positionné par encastrement sur la queue d'aronde moulée sur le débitmètre dont le ludion doit être obligatoirement magnétique. Par le passage du flotteur magnétique le contact est activé.

CARACTERISTIQUES

- Fonctionnement bistable
- élevée resistance aux vibrations
- absence d'effets de retour
- absence d'interférences avec un deuxième microinterrupteur
- inertie réduit au minimum
- protection: IP 65
- connection facile
- une version spéciale avec TRIAC est disponible sur demande

Kontaktschalter K18

Die bistabile Kontakteinrichtung 024.86 besteht aus einem Kontakt-Federsatz, der in einem mit Schutzgas gefüllten Glasröhrchen eingeschmolzen ist. Die Kontaktfedern werden durch einen festjustierten Permanentmagneten so polarisiert, daß sie ein bistabiles Verhalten zeigen.

Die Kontaktschalter 024.86.05 und 024.86.06 sind mit einem TRIAC versehen.

HAUPTMERKMALE

- Bistabiles Verhalten
- vibrationsunempfindlich
- rückwirkungsfrei
- keine gegenseitige Beeinflussung der Kontakte
- minimale Massenträgheit
- Schutzart: IP 65
- einfacher Einbau
- Sonderausführungen mit TRIAC 024.86.05 und 024.86.06 lieferbar.

Microinterruttore di MAX.

Normalmente questo sensore è usato come allarme di Massimo. Quando il galleggiante si trova al di sotto del sensore, il contatto risulta aperto. (fig. 1) Quando il galleggiante oltrepassa la posizione del sensore (dal basso verso l'alto), il contatto verrà chiuso. (fig. 2) Il contatto sarà mantenuto chiuso fino al passaggio del galleggiante (dall'alto verso il basso).

MAX. point control switch

Normally this sensor is used as Maximum alarm. When the floater is below the position of the switch, the contact is open. (fig. 1) When the floater comes across (bottom-up) the switch the contact will close. (fig. 2) The contact will keep the status until the floater will pass again (top-down) in front of the switch.

ZMS248605**Interrupteur à MAX.**

Ce débitmètre est normalement utilisé comme alarme de min. Quand le flotteur se trouve au dessous de la position du switch, le contact est ouvert. (fig. 1) Quand le flotteur passe (du bas en haut) la position du switch le contact est fermé. (fig. 2) Le contact reste dans sa condition jusqu'à le flotteur ne bouge pas (du haut en bas) devant le switch.

MAXimumgrenzwertschalter

Normalerweise ist dieser Sensor als Maximumalarm benutzt. Wenn der Schwimmer unter der Position vom Schalter ist, ist der Kontakt offen. (fig. 1) Wenn der Schwimmer (von unten nach oben) den Schalter überschreitet, dann wird der Kontakt geschlossen. (fig. 2) Der Kontakt wird den Status behalten, bis der Schwimmer wieder (von oben nach unten) vor dem Schalter vorbeigehen wird.





FL-FC

ZMS248606

Microinterruttore di MIN.

Normalmente questo sensore è usato come allarme di Minimo. Quando il galleggiante si trova al disopra del sensore, il contatto risulta aperto. (fig. 1) Quando il galleggiante oltrepassa la posizione del sensore (dall'alto verso il basso), il contatto verrà chiuso. (fig. 3) Il contatto sarà mantenuto chiuso fino al passaggio del galleggiante (dall'alto verso il basso).

MIN. point control switch

Normally this sensor is used as Minimum alarm. When the floater is over the position of the switch, the contact is open. (fig. 1) When the floater comes across (top-down) the switch the contact will close. (fig. 3) The contact will keep the status until the floater will pass again (bottom-up) in front of the switch.

Interrupteur à MIN.

Ce débitmètre est normalement utilisé comme alarme de min. Quand le flotteur se trouve au dessus de la position du switch, le contact est ouvert. (fig. 1) Quand le flotteur passe (du haut en bas) la position du switch le contact est fermé. (fig. 3) Le contact reste dans sa condition jusqu'à le flotteur ne bouge pas (du bas en haut) devant le switch.

MINimumgrenzwertschalter

Normalerweise ist dieser Sensor als Minimumalarm benutzt. Wenn der Schwimmer über der Position vom Schalter ist, ist der Kontakt offen. (fig. 1) Wenn der Schwimmer (von oben nach unten) den Schalter überschreitet, dann wird der Kontakt geschlossen. (fig. 3) Der Kontakt wird den Status behalten, bis der Schwimmer wieder (von unten nach oben) vor dem Schalter vorbeigehend wird.

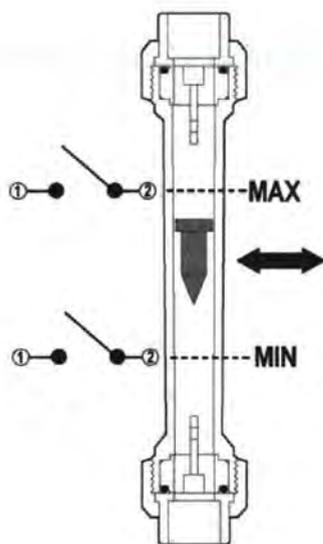


Fig. 1

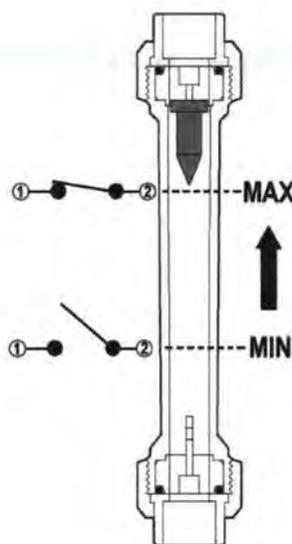


Fig. 2

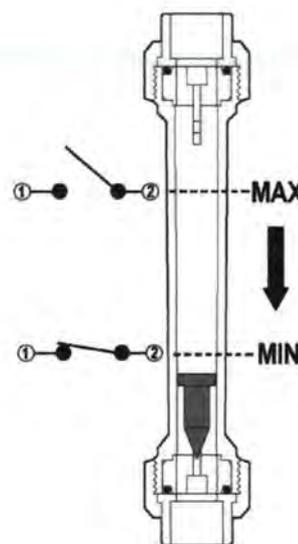


Fig. 3

Se è necessario ottenere il contatto di Minimo con funzione normalmente chiuso, è possibile installare il sensore di Massimo nella parte bassa del flussimetro.

Where needed a MIN. contact working as normally closed, it is possible to install the MAX. point control switch in the lower part of the flowmeter.

Lorsque on nécessite un contact de MIN. avec fonction NO (normalement fermé) il est possible de installer le switch de MAX dans la partie la plus basse du débitmètre.

Wo man ein MIN. Kontakt braucht, der als normalgeschlossen arbeitet, ist es möglich, den MAX Grenzwertschalter im unteren Teil vom Flowmeter zu installieren.

NOTA: non è possibile ottenere il contatto di Massimo normalmente chiuso.

NOTE: it is NOT possible to get a MAX. contact working as normally closed.

NOTE: ce n'est pas possible d'utiliser un switch de MAX. avec fonction de NO (normalement fermé).

NOTE: es ist NICHT möglich, dass ein MAX Kontakt als normalgeschlossen arbeitet.

**FL-FC****Accessori****Accessories****Accessoires****Zubehör****ZMS248605 - ZMS248606****Dati
Tecnici****Technical
Data****Données
Techniques****Technische
Daten**

Materiale dei contatti:	Rodio con gas inerte protettivo
Max potenza di esercizio:	10 Watt, 12 VA
Max tensione di esercizio:	250 V AC/DC
Resistenza dei contatti:	0.1 Ω
Resistenza d'isolamento contatti:	10 ¹¹ Ω
Tempo di chiusura:	2 ms
Tempo di apertura:	0.07 ms
Frequenza impulsi:	2000 impulsi/sec
Temperatura:	da - 40 a + 80°C
Materiale del corpo:	tecnopolimero
Connessione:	DIN 43650
Protezione:	IP 65
Max picco di corrente:	0.5 A
Max corrente:	22 mA @ 220 V = 45 mA @ 110 V = 0.2 A @ 24 V = 0.5 A @ 10 V =

ATTENZIONE: Superare i valori suddetti può causare l'incollaggio dei contatti.

Matériaux du contact:	Rhodium avec gaz inert de protection
Max puissance:	10 Watt, 12 VA
Max tension:	250 V AC/DC
Résistance:	0.1 Ω
Résistance au guipage:	10 ¹¹ Ω
Temps de fermeture:	2 ms
Temps d'ouverture:	0.07 ms
Fréquence des pulsations:	2000 puls./sec.
Température:	- 40 ÷ + 80°C
Matériaux du corps:	technopolymère
Prise électrique:	DIN 43650
Degré de protection:	IP 65
Max crête d'entrée:	0.5 A
Max courant:	22 mA @ 220 V = 45 mA @ 110 V = 0.2 A @ 24 V = 0.5 A @ 10 V =

ATTENTION: Le doublage de cette valeurs peut entraîner le collage ds contacts.

Contact Material:	Rhodium with inert protective gas
Max operating power:	10 Watt, 12 VA
Max operating voltage:	250 V AC/DC
Contact resistance:	0.1 Ω
Contact insulation resistance:	10 ¹¹ Ω
Closing time:	2 ms
Opening time:	0.07 ms
Pulses rate:	2000 pulses/sec
Temperature:	- 40 ÷ + 80°C
Body material:	technopolymer
Connection:	DIN 43650
Protection:	IP 65
Max input peak:	0.5 A
Max current:	22 mA @ 220 V = 45 mA @ 110 V = 0.2 A @ 24 V = 0.5 A @ 10 V =

CAUTION: The overshooting of the above values may cause contacts sticks

Kontaktmaterial:	Rhodium mit inaktivem Schutzgas
Max Schaltleistung:	10 Watt, 12 VA
Max Schaltspannung:	250 V AC/DC
Kontaktwiderstand:	0.1 Ω
Kontaktisolationwiderstand:	10 ¹¹ Ω
Kontaktschließzeit:	2 ms
Kontaktöffnungszeit:	0.07 ms
Schalhäufigkeit:	2000 Schaltungen/sec
Temperaturbereich:	- 40 ÷ + 80°C
Gehäuse-Werkstoff:	Kunststoff
Anschluß:	DIN 43650
Schutzart:	IP 65
Max Einschaltspitzenstrom:	0.5 A
Max Schaltstrom:	22 mA @ 220 V = 45 mA @ 110 V = 0.2 A @ 24 V = 0.5 A @ 10 V =

ACHTUNG: Beim Überschreiten dieser Werte können sich Kontaktverschweißungen ergeben

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FL-FC

Accessori

Accessories

Accessoires

Zubehör

Trasmettitore

- Il trasmettitore ZFT02486070 genera un segnale in corrente proporzionale alla portata, dai flussimetri tipo FL dotati di galleggiante magnetico.
- Il trasmettitore genera un segnale 4 ± 20 mA con una alimentazione massima di 40 V.
- La calibrazione si regola per mezzo di due trimmers, a cui si accede rimuovendo vite ed o-ring nelle posizioni (3) e (4).
- A causa della linearità del segnale di output e della non linearità del segnale di input dal flussimetro, è consigliabile prendere il 20% e l'80% della portata nel flussimetro come base per la calibrazione.
- Il trasmettitore viene installato lateralmente sul flussimetro, e viene fissato tramite le viti (5).
- **Fare attenzione ad installare il trasmettitore nella posizione corretta! (connettore verso il basso!)**
- Il trasmettitore deve essere montato e regolato da personale qualificato.
- Il trasmettitore è praticamente esente da manutenzione. Tuttavia si consiglia di verificare periodicamente le guarnizioni ed i collegamenti.

Transmitter

- The transmitter ZFT02486070 is designed to provide an output signal from flowmeters type FL with magnetic floater.
- The transmitter is designed to generate a 4 ± 20 mA signal with a maximum supply of 40 V.
- Calibration is adjusted by two trimmers which are reached by removing screw and o-ring (pos. 3+4).
- Due to the linear output signal and the non-linear input signal from the flow meter, it is advisable to take 20% and 80% of the media flow rate in the flow meter as a basis for calibration when making adjustments.
- The housing is installed on the side of the flowmeter. It needs to be fixed via the screws (pos. 5).
- **Be careful to install the transmitter in the correct position ! (Gland downward !).**
- The transmitter should only be mounted and maintained by qualified personnel.
- The transmitter is maintenance-free. However it is advisable to check the condition of the seals and the wiring connection periodically.

Transmetteur

- Le transmetteur ZFT02486070 émet un signal en sortie du débitmètre type FL avec flotteur magnétique.
- Le transmetteur émet un signal de 4 ± 20 mA, avec une alimentation maximale de 40V.
- La calibration est réglée par deux vis, qu'on peut atteindre en enlevant vis et o-ring (pos.3+4).
- À cause de la linéarité du signal sortie et de la non-linéarité du signal entrée du débitmètre, il est conseillé de prendre le 20% et le 80% du débit comme base pour le calibrage.
- Le transmetteur est installé latéralement au débitmètre. On doit le fixer avec les vis (pos.5).
- **Il faut faire attention à installer le transmetteur dans la position correcte! (Prise vers le bas).**
- Le transmetteur doit être monté par personnel qualifié.
- Le transmetteur est exempt de entretien. Toutefois il est conseillé de vérifier les conditions des joints et des connections électriques périodiquement.

ZFT02486070

Meßwertumformer

- Der Meßwertumformer 024.86.070 dient zur Meßwerterfassung bei Durchflußmessern der Baureihen 785/786 (FL) mit magnetische Körper.
- Der Meßwertumformer ist dafür ausgelegt, einen Strom von 4 mA bis max 20 mA zu liefern, bei bis zu 40V Versorgungsspannung.
- Die Abgleichung der Werte sowie die Anpassung der Kurve geschieht mittels zwei Potentiometern, die zu erreichen sind, wenn man den Stopfen (Pos. 4) entfernt.
- Aufgrund des linearen Ausgangssignales und des nichtlinearen Eingangssignales vom Durchflußmesser wird empfohlen, als Eichpunkte 20% und 80% des Volumenstromes zu verwenden.
- Das Gehäuse wird durch Gewindestifte (Pos. 5) auf den Schwalbenschwanz am Durchfluß-messer geklemmt.
- **Es ist auf die korrekte Einbaulage zu achten ! (Stecker oben !).**
- Darf nur von geschultem und erfahrenem Fachpersonal montiert und betrieben werden.
- Der Meßwertumformer ist wartungsfrei. Dennoch wird empfohlen, in gewissen Intervallen den Zustand des O-Ringes und der Flachdichtung, sowie den Kontakt der Leitungen zu überprüfen.



FL-FC

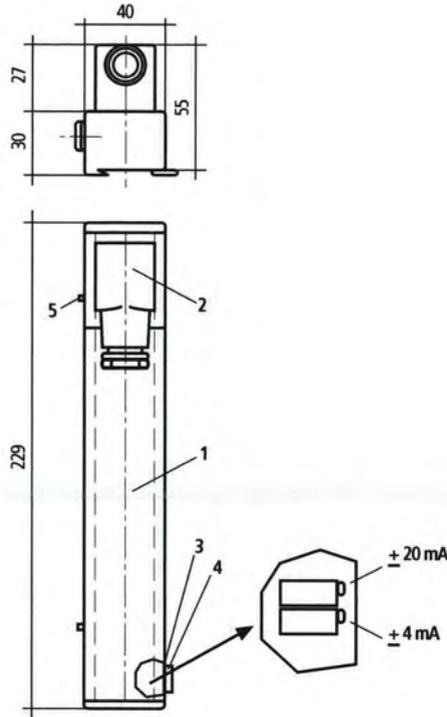
Accessori

Accessories

Accessoires

Zubehör

ZFT02486070



Pos.	Componenti	Materiale	Q.tà	Pos.	Composants	Materiaux	Q.té
1	corpo del trasmettitore	Fibron	1	1	corps de l'émetteur	Fibron	1
2	connettore con guarnizione		1	2	connecteur électrique		1
3	O-Ring 9x2	FPM	1	3	O-Ring 9x2	FPM	1
4	vite	PA	1	4	vis	PA	1
5	vite M3 x 10	acciaio	2	5	vis M3 x 10	acier	2

Pos.	Components	Material	Q.ty	Pos.	Benennung	Werkstoff	Stück
1	housing	Fibron	1	1	Gehäuse	Fibron	1
2	plug including seal		1	2	Steckdose inkl. Dichtung		1
3	O-Ring 9x2	FPM	1	3	O-Ring 9x2	FPM	1
4	screw	PA	1	4	Stopfen	PA	1
5	screw M3 x 10	steel	2	5	Gewinde Stift M3 x 10	Edelstahl	2



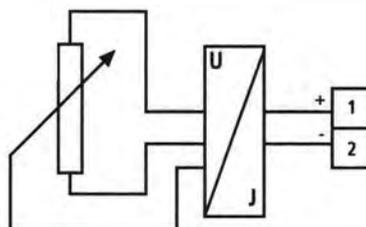


FL-FC

Accessori**Accessories****Accessoires****Zubehör****ZFT02486070****Dati
Tecnici****Technical
Data****Données
Techniques****Technische
Daten**

Segnale di ingresso	50 contatti Reed a 4 mm uno dall'altro (lunghezza totale 200 mm)	Signal entrée	50 contacts Reed à 4 mm un de l'autre (longueur total 200 mm)
Alimentazione	da 10V + (0,02A*RLast) a 40V + (0,004*RLast) Corrente continua	Alimentation	de 10V + (0,02A*RLast) à 40V + (0,004*RLast) Courant continue
Segnale in uscita	4 ÷ 20 mA (proporzionale al numero di contatti reed attivi). E' possibile tarare sia il valore minimo che il massimo.	Signal en sortie	4 ÷ 20 mA (proportionnel au numéro des contacts reed actives). Il est possible graduer soit le valeur minimale que le valeur maximale.
Connessione	Connettore DIN 43650 Passacavo PG9	Connexion	Connecteur électrique normalisée DIN 43650 Passage des cables PG9
Protezione Normative	IP 65 CE secondo 93/465/EWG (89/336/EWG; 73/23/EWG; 93/23/EWG)	Protection électrique Standard	IP 65 CE selon 93/465/EWG (89/336/EWG; 73/23/EWG; 93/23/EWG)

Signal Input	50 Reed switches 4 mm apart from each other (total length 200 mm)	Meßwerterfassung	50 Reedswitcher im Abstand von 4 mm (Gesamtmeßlänge 200 mm)
Electrical Input	10VDC + (0,02A*RLast) up to 40VDC + (0,004*RLast) Continous current	Stromversorgung	10V + (0,02A*RLast) bis 40V + (0,004*RLast) Gleichspannung
Electrical Output	4 ÷ 20 mA (dependent on the number of energized reed switches). The lower value as well as the whole range is adjustable	Meßwert-Ausgang	4 ÷ 20 mA (abhängig von den betätigten Reed-kontakten). Der untere Grenzwert sowie die Steilheit der Kurve ist abgleichbar.
Connection	Plug acc. DIN 43650. Socket with PG9-gland.	Anschluß	Stecker nach DIN 43650 Gerätesteckdose mit PG9-Verschraubung.
Electrical Protection Standards	IP 65 CE acc. 93/465/EWG (89/336/EWG; 73/23/EWG; 93/23/EWG)	Schutzart Bescheinigungen/ Zulassungen	IP 65 CE acc. 93/465/EWG (89/336/EWG; 73/23/EWG; 93/23/EWG)

Schema elettrico**Wiring diagram****Schéme électrique****Schaltbild**

APPENDIX 13



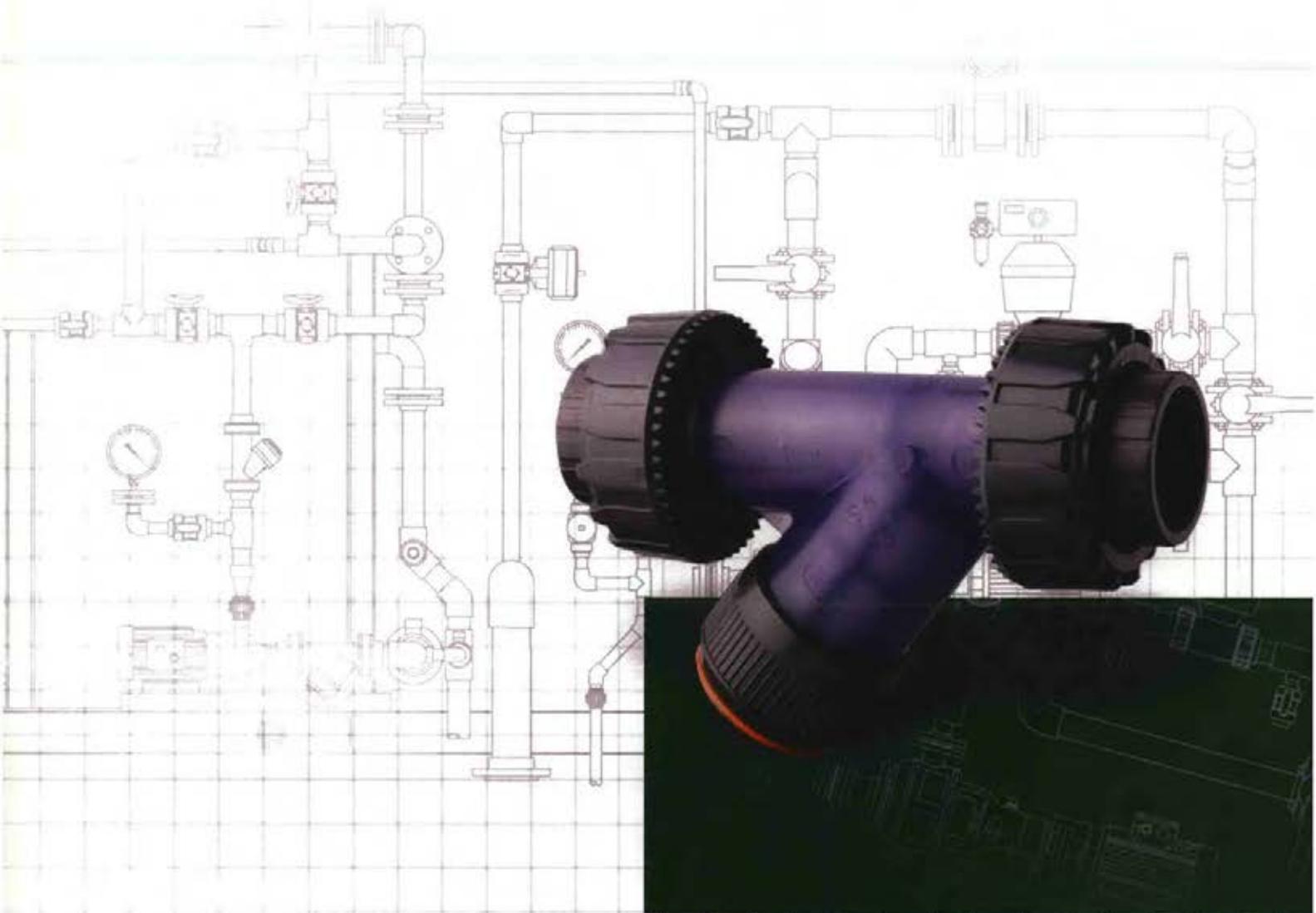
Raccoglitore di impurità

Sediment strainer

Filtre à tamis

Schmutzfänger

RV PVC-U



RV PVC-U

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RV PVC-U

Raccoglitore di impurità

- Il raccoglitore di impurità FIP elimina dal fluido di esercizio le impurità solide mediante una retina filtrante
- Gamma dimensionale da d 16 mm a d 110 mm, da R 3/8" a R 4"
- Resistenza a pressioni di esercizio fino a 16 bar a 20° C (acqua)
- Idoneità del PVC-U impiegato a venire in contatto con acqua potabile ed altre sostanze alimentari secondo le leggi vigenti
- Possibilità di effettuare la manutenzione con il corpo valvola installato
- Per maggiori informazioni visitare il sito: www.fipnet.it

Sediment strainer

- FIP sediment strainer removes solid impurities in suspension in the fluid conveyed by means of a filter screen
- Size range from d 16 mm up to d 110 mm
- Pressure rating: maximum working pressure: up to 16 bar at 20° C (water)
- FIP PVC-U is suitable for conveying foodstuffs and drinking water and meets the necessary standards and regulations
- Maintenance can be carried out while the valve body is installed in line
- For more information please visit our website: www.fipnet.it

Filtre à tamis

- Le filtre à tamis FIP élimine les impuretés solides de fluide, à l'aide d'un tamis
- Gamme dimensionnelle de d 16 mm jusqu'à d 110 mm
- Pression de service jusqu'à 16 bar à 20° C (eau)
- PVC-U à qualité alimentaire apte à l'utilisation avec l'eau potable et les aliments suivant les règlements en vigueur
- Possibilité d'effectuer l'entretien sans devoir démonter le corps
- Pour avoir d'autres informations, visiter le site: www.fipnet.it

Schmutzfänger

- FIP-Schmutzfänger halten mit ihrem Filternetz Verunreinigungen des Mediums zurück
- Abmessungsbereich von d 16 mm bis d 110 mm
- Druck: max. Betriebsdruck 16 bar bei 20° C (Wasser)
- FIP PVC-U entspricht den geltenden Vorschriften und ist für Trinkwasser oder andere für den Verzehr bestimmte Medien zugelassen
- Bei Wartungsarbeiten kann das Gehäuse in der Rohrleitung verbleiben
- Für weitere Details schauen Sie auf unsere Website: www.fipnet.it

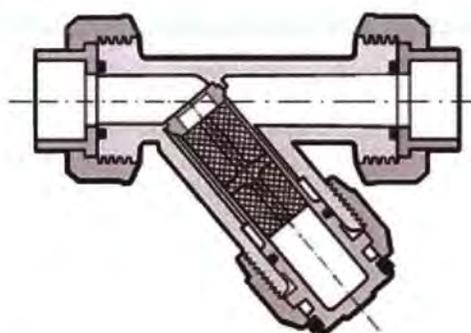


Fig. A

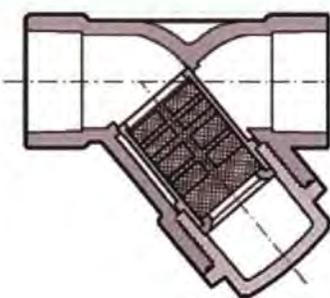


Fig. B

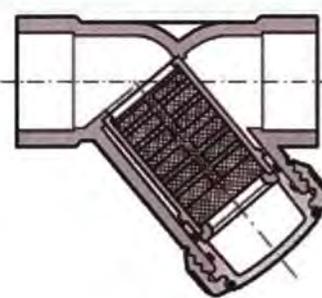


Fig. C

Legenda

d	diametro nominale esterno in mm	d	nominal outside diameter in mm	d	diamètre extérieur nominal en mm	d	Rohraußendurchmesser, mm
DN	diametro nominale interno in mm	DN	nominal internal diameter in mm	DN	diamètre nominal intérieur en mm	DN	Nennweite, mm
R	dimensione nominale della filettatura in pollici	R	nominal size of the thread in inches	R	dimension nominale du filetage en pouces	R	Gewinde (DIN 2999, T1)
PN	pressione nominale in bar (pressione max di esercizio a 20° C - acqua - 50 anni)	PN	nominal pressure in bar (max. working pressure at 20° C - water - 50 years)	PN	pression nominale en bar (pression de service max à 20° C - eau - 50 années)	PN	Nenndruck, bar (max Betriebsdruck bei Wasser 20° C -50 Jahre)
g	peso in grammi	g	weight in grams	g	pois en grammes	g	Gewicht in Gramm
K	chiave del coperchio	K	bonnet wrench opening	K	clef du couvercle	K	Schlüsselweite
PVC-U	cloruro di polivinile rigido	PVC-U	uniplasticized polyvinyl chloride	PVC-U	polychlorure de vinyle non plastifié	PVC-U	Polyvinylchlorid, hart ohne Weichmacher
EPDM	elastomero etilene propilene	EPDM	ethylene propylene rubber	EPDM	élastomère éthylène propylène	EPDM	Äthylen-Propylen-Kautschuk
FPM (FKM)	fluoroelastomero	FPM (FKM)	vinylidene fluoride rubber	FPM (FKM)	fluoroélastomère de vinylidène	FPM (FKM)	Fluor-Kautschuk



RV PVC-U

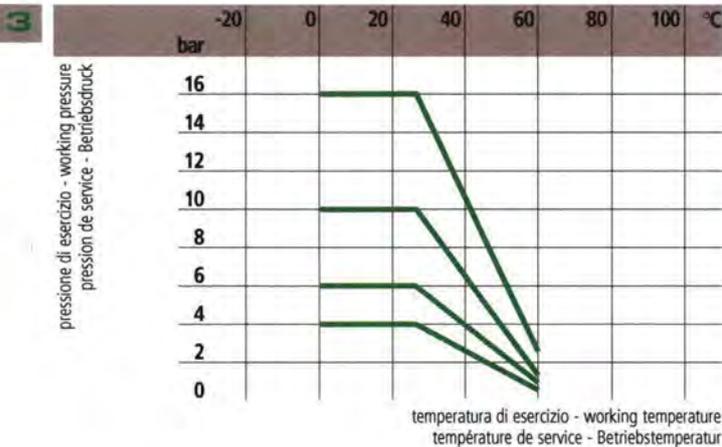
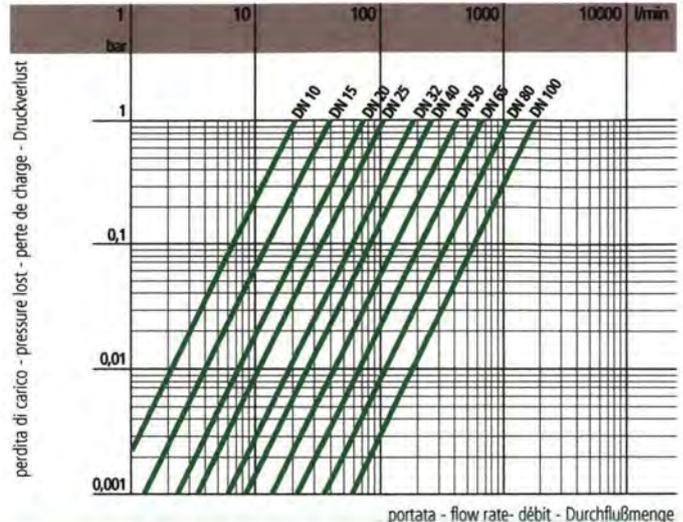
Dati Tecnici

Technical Data

Données Techniques

Technische Daten

passo (mm) hole pitch (mm) pas de perforation (mm) Maschenabstand (mm)	0,7	1,0	1,5	2,0	2,5
numero di fori per cm ² holes per cm ² n. des perforations par cm ² Lochzahl/cm ²	240	190	100	60	35
serie ASTM equivalente in mesh equivalent ASTM mesh size dimensions des perforations selon ASTM äquivalente ASTM Maschengröße	35	50	35	30	18
Ø foro equivalente µm Ø equivalent hole µm Ø perforation équivalente µm Ø Gleighwertige Bohrung µm	500	300	500	600	900
materiale della retina screen material matériaux Filternetz	Inox	PVC-U	PVC-U	PVC-U	PVC-U



d	16	20	25	32	40	50	63	75	90	110
DN	10	15	20	25	32	40	50	65	80	100
At	16	16	23,5	36	53	69	101	197	247	396

d	16	20	25	32	40	50	63	75	90	110
DN	10	15	20	25	32	40	50	65	80	100
K _{v100}	22	40	70	103	188	255	410	650	1050	1700

1 Dimensioni della retina

Filter screen sizes

Dimensions du tamis

Filternetz-Abmessungen

2 Diagramma delle perdite di carico

Pressure loss chart

Diagramme de perte de charge

Druckverlust-Diagramm

3 Variazione della pressione in funzione della temperatura per acqua o fluidi non pericolosi nei confronti dei quali il PVC-U è classificato CHIMICAMENTE RESISTENTE. Vedere il prospetto "Guida alla resistenza chimica". In altri casi è richiesta un'adeguata diminuzione della pressione nominale PN. 50 anni secondo DIN 3441

Pressure/temperature rating for water and harmless fluids to which PVC-U is RESISTANT. See "A guide to chemical resistance". In other cases a reduction of the rated PN is required. 50 years according to DIN 3441

Variation de la pression en fonction de la température pour l'eau et les fluides non agressifs pour lesquels le PVC-U est considéré CHIMIQUEMENT RESISTANT. Voir "Guide de résistance chimique". Pour les autres cas une diminution du PN est nécessaire. 50 années selon DIN 3441

Druck/Temperatur Diagramm für Wasser und ungefährliche Medien wogegen die PVC-U beständig ist (siehe Beständigkeitsliste). In allen anderen Fällen ist eine Reduzierung der Druckstufe erforderlich. 50 Jahre nach DIN 3441

4 Superficie totale di filtraggio At (cm²)

Total filtering screen surface At (cm²)

Surface filtrante du tamis At (cm²)

Filteroberfläche, total At (cm²)

5 Coefficiente di flusso K_{v100}
Per coefficiente di flusso K_{v100} si intende la portata Q in litri al minuto di acqua a 20° C che genera una perdita di carico Δp = 1 bar per una determinata apertura della valvola. I valori K_{v100} indicati in tabella si intendono per valvola completamente aperta.

Flow coefficient K_{v100}
K_{v100} is the number of litres per minute of water at a temperature of 20° C that will flow through a valve with a one-bar pressure differential at a specified rate. The K_{v100} values shown in the table are calculated with the valve completely open.

Coefficient de débit K_{v100}
K_{v100} est le nombre de litres par minute d'eau, à une température de 20° C, qui s'écoule dans une vanne de régulation avec une pression différentielle de 1 bar, à une vitesse donnée. Les valeurs K_{v100} indiquées sur la table sont évaluées lorsque le robinet est entièrement ouvert.

K_{v100} -Werte
Der K_{v100}- Wert nennt den Durchsatz in l/min für Wasser bei 20° C und einem Δp von 1 bar bei völlig geöffnetem Ventil.

RV PVC-U

Dimensioni

La FIP ha approntato una gamma di valvole di ritegno i cui attacchi sono in accordo con le seguenti norme:
 incollaggio: ISO 727, UNI EN 1452, DIN 8063, NF T54 028
 filettatura: UNI-ISO 228/1, DIN 2999
 flangiatura: ISO 2084, UNI EN 1452, DIN 8063
 accoppiabili con tubi secondo ISO 161/1, UNI EN 1452, DIN 8062, NF T54 016

Dimensions

FIP have produced a complete range of check valves whose joints comply with the following standards:
 solvent welding: ISO 727, UNI EN 1452, DIN 8063, NF T54 028
 threaded coupling: UNI-ISO 228/1, DIN 2999
 flanged joints: ISO 2084, UNI EN 1452, DIN 8063
 coupling to pipes complying ISO 161/1, UNI EN 1452, DIN 8062, NF T54 016

Dimensions

FIP a réalisé une gamme complète de clapets de retenue dont les embouts sont conformes aux normes suivantes:
 encollage: ISO 727, UNI EN 1452, DIN 8063, NF T54 028
 filetage: UNI-ISO 228/1, DIN 2999
 brides: ISO 2084, UNI EN 1452, DIN 8063
 assemblés à des tubes conformes aux ISO 161/1, UNI EN 1452, DIN 8062, NF T54 016

Dimensionen

Anschluß-Möglichkeiten unter Berücksichtigung internationaler Normen. Die Rückschlagventil-reihe entspricht folgenden Normen:
 Klebeanschluß: ISO 727, UNI EN 1452, DIN 8063, NF T54 028
 Gewindeverbindung: UNI-ISO 228/1, DIN 2999
 Flanschanschluß: ISO 2084, UNI EN 1452, DIN 8063
 für Rohre nach ISO 161/1, UNI EN 1452, DIN 8062, NF T54 016

RVUIV-RVUIT

RVUIV PVC-U rigido
RVUIT PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
 con attacchi a bocchettone femmina per incollaggio

RVUIV grey PVC-U
RVUIT transparent PVC-U

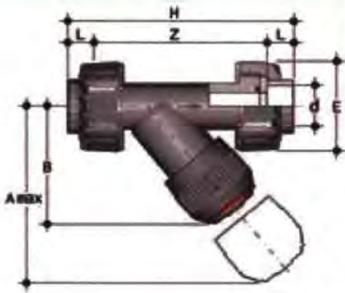
SEDIMENT STRAINER
 with unionized metric series plain female ends for solvent welding

RVUIV PVC-U gris
RVUIT PVC-U transparent

FILTRE À TAMIS
 avec raccordement union femelles à coller

RVUIV PVC-U opak
RVUIT PVC-U transparent

SCHMUTZFÄNGER
 mit Klebemuffen
 21.305.05... opak
 52.305.05... transparent



d	DN	PN		A max	B	E	L	Z	H	K	g	Fig.
		RVUIV	RVUIT									
16	10	16	16	125	72	55	14	107	135	-	203	A
20	15	16	16	125	72	55	16	103	135	-	211	A
25	20	16	16	145	84	66	19	120	158	-	358	A
32	25	16	16	165	95	75	22	132	176	-	526	A
40	32	16	10	190	111	87	26	155	207	-	733	A
50	40	16	10	210	120	100	31	181	243	-	1095	A
63	50	16	10	240	139	120	38	222	298	-	1843	A

also available with ASTM/NPT standard end connectors

RVIV-RVIT

RVIV PVC-U rigido
RVIT PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
 con affacchi femmina per incollaggio

RVIV grey PVC-U
RVIT transparent PVC-U

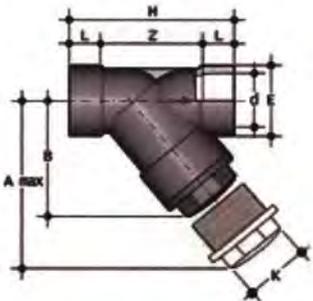
SEDIMENT STRAINER
 with metric series plain female ends for solvent welding

RVIV PVC-U gris
RVIT PVC-U transparent

FILTRE À TAMIS
 avec embouts femelles à coller

RVIV PVC-U opak
RVIT PVC-U transparent

SCHMUTZFÄNGER
 mit Klebemuffen
 21.305.02... opak
 52.305.02... transparent



d	DN	PN		A max	B	E	L	Z	H	K	g	Fig.
		RVIV	RVIT									
75	65	10	6	300	179	104	44	155	243	96	2385	B
90	80	6	4	325	192	116	51	160	262	105	2975	B
110	100	6	4	385	231	138	61	203	325	-	4610	C

RV PVC-U

RVUFV-RVUFT

RVUFV PVC-U rigido
RVUFT PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
con attacchi a bocchettone
femmina filettatura cilindrica gas



RVUFV grey PVC-U
RVUFT transparent PVC-U

SEDIMENT STRAINER
with unionized BS parallel threaded
female ends

RVUFV PVC-U gris
RVUFT PVC-U transparent

FILTRE À TAMIS
avec raccordement union, embouts
taraudés, filetage cylindrique gaz

RVUFV PVC-U opak
RVUFT PVC-U transparent

SCHMUTZFÄNGER
mit Gewindemuffen
21.305.06... opak
52.305.06... transparent

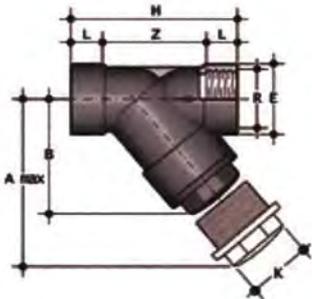
R	DN	PN		A	B	E	L	Z	H	K	g	Fig.
		RVUFT	RVUFV	max								
3/8"	10	16	16	125	72	55	11,4	112,2	135	-	206	A
1/2"	15	16	16	125	72	55	15	112	142	-	210	A
3/4"	20	16	16	145	84	66	16,3	126,4	159	-	355	A
1"	25	16	16	165	95	75	19,1	144,8	183	-	522	A
1 1/4"	32	10	16	190	111	87	21,4	171,2	214	-	742	A
1 1/2"	40	10	16	210	120	100	21,4	192,2	235	-	1106	A
2"	50	10	16	240	139	120	25,7	233,6	285	-	1873	A

also available with JIS standard end connectors

RVFV-RVFT

RVFV PVC-U rigido
RVFT PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
con attacchi femmina filettatura
cilindrica gas



RVFV grey PVC-U
RVFT transparent PVC-U

SEDIMENT STRAINER
with BS parallel threaded female
ends

RVFV PVC-U gris
RVFT PVC-U transparent

FILTRE À TAMIS
avec embouts taraudés, filetage
cylindrique gaz

RVFV PVC-U opak
RVFT PVC-U transparent

SCHMUTZFÄNGER
mit Gewindemuffen
21.305.01... opak
52.305.01... transparent

R	DN	PN		A	B	E	L	Z	H	K	g	Fig.
		RVFT	RVFV	max								
2 1/2"	65	10	6	300	179	104	30,2	182,6	243	96	2385	B
3"	80	6	4	325	192	116	33,3	195,4	262	105	2965	B
4"	100	6	4	385	231	138	39,3	246,4	325	-	4405	C

RVUAT

PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
con attacchi a bocchettone femmina
per incollaggio, serie ASTM



transparent PVC-U

SEDIMENT STRAINER
with unionized ASTM series plain
female ends for solvent welding

PVC-U transparent

FILTRE À TAMIS
avec raccordement union, embouts
femelles à coller, série ASTM

PVC-U transparent

SCHMUTZFÄNGER
mit ASTM Klebemuffen

d	DN	PN		A	B	E	L	Z	H	K	g	Fig.
				max								
3/8"	10	16		125	72	55	19,5	110	149	-	203	A
1/2"	15	16		125	72	55	22,5	104	149	-	211	A
3/4"	20	16		145	84	66	25,5	121	172	-	358	A
1"	25	16		165	95	75	28,7	132,6	190	-	526	A
1 1/4"	32	10		190	111	87	32	159	223	-	733	A
1 1/2"	40	10		210	120	100	35	181	251	-	1095	A
2"	50	10		240	139	120	38,2	221,6	298	-	1843	A

RV PVC-U

RVAT

PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
con attacchi femmina per incollaggio,
serie ASTM



transparent PVC-U

SEDIMENT STRAINER
with ASTM series plain female ends
for solvent welding

PVC-U transparent

FILTRE ÉPURATEUR À TAMIS
avec embouts femelles à coller, série
ASTM

PVC-U transparent

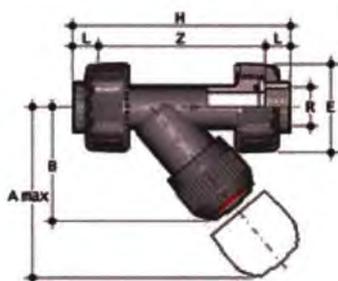
SCHMUTZFÄNGER
mit ASTM Klebemuffen

d	DN	PN	A max	B	E	L	Z	H	K	g	Fig.
3"	80	4	325	192	116	47,6	166,8	262	105	2975	B
4"	100	4	385	231	138	57,2	210,6	325	-	4610	C

RVUNT

PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
con attacchi a bocchettone femmina
filettatura NPT



transparent PVC-U

SEDIMENT STRAINER
with unionized NPT threaded female
ends

PVC-U transparent

FILTRE À TAMIS
avec raccordement union, embouts
taraudés filetage NPT

PVC-U transparent

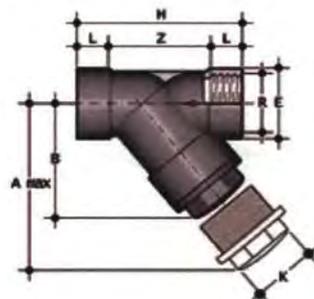
SCHMUTZFÄNGER
mit NPT Gewindemuffen

R	DN	PN	A max	B	E	L	Z	H	K	g	Fig.
3/8"	10	16	125	72	55	13,7	107,6	135	-	206	A
1/2"	15	16	125	72	55	17,8	107,4	143	-	210	A
3/4"	20	16	145	84	66	18	123	159	-	355	A
1"	25	16	165	95	75	22,6	137,8	183	-	522	A
1" 1/4	32	10	190	111	87	25,1	163,8	214	-	742	A
1" 1/2	40	10	210	120	100	24,7	185,6	235	-	1106	A
2"	50	10	240	139	120	29,6	225,8	285	-	1873	A

RVNT

PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
con attacchi femmina filettatura NPT



transparent PVC-U

SEDIMENT STRAINER
with NPT threaded female ends

PVC-U transparent

FILTRE À TAMIS
avec embouts taraudés filetage NPT

PVC-U transparent

SCHMUTZFÄNGER
mit NPT Gewindemuffen

R	DN	PN	A max	B	E	L	Z	H	K	g	Fig.
3"	80	4	325	192	116	51	160	262	105	2965	B
4"	100	4	385	231	138	61	203	325	-	4405	C

RV PVC-U

RVDV-RVDT

RVDV PVC-U rigido
RVDT PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
con attacchi maschio per incollaggio

RVDV grey PVC-U
RVDT transparent PVC-U

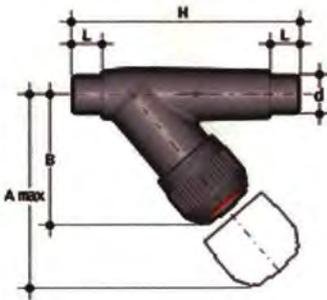
SEDIMENT STRAINER
with metric series plain male ends for
solvent welding

RVDV PVC-U gris
RVDT PVC-U transparent

FILTRE À TAMIS
avec embouts mâle à coller

RVDV PVC-U opak
RVDT PVC-U transparent

SCHMUTZFÄNGER
mit Kiebestutzen
21.305.00...opak
52.305.00...transparent



d	DN	PN		A max	B	L	H	g	Fig.
		RVDV	RVDT						
16	10	16	10	125	72	14	114	110	A
20	15	16	10	125	72	16	124	120	A
25	20	16	10	145	84	19	144	190	A
32	25	16	10	165	95	22	154	285	A
40	32	16	10	190	111	26	174	400	A
50	40	16	10	210	120	31	194	600	A
63	50	16	10	240	139	38	224	945	A

RVOV-RVOT

RVOV PVC-U rigido
RVOT PVC-U trasparente

RACCOGLITORE DI IMPURITÀ
con flange libere DIN 8063 PN 10-16
(ODV+QPV) accoppiabili con flange
ODV e collari QGV

RVOV grey PVC-U
RVOT transparent PVC-U

SEDIMENT STRAINER
with DIN 8063 PN 10-16
(ODV+QPV) backing rings coupling
to backing rings QGV

RVOV PVC-U gris
RVOT PVC-U transparent

FILTRE À TAMIS
avec brides libres DIN 8063
PN 10-16 (ODV+QPV)

RVOV PVC-U opak
RVOT PVC-U transparent

SCHMUTZFÄNGER
mit Flanschen
21.305.04...opak
52.305.04...transparent



d	DN	PN		A max	B	H	F	f	g	Fig.
		RVOV	RVOT							
20	15	16	10	125	72	130	65	14	260	A
25	20	16	10	145	84	150	75	14	395	A
32	25	16	10	165	95	160	85	14	560	A
40	32	16	10	190	111	180	100	18	850	A
50	40	16	10	210	120	200	110	18	1170	A
63	50	16	10	240	139	230	125	18	1760	A
75	65	10	6	300	179	356	145	17	3600	B
90	80	6	4	325	192	404	160	17	4910	B
110	100	6	4	385	231	475	180	17	6790	C

RV PVC-U**Installazione sull'impianto**

- 1) Il raccoglitore può essere installato in qualsiasi posizione avendo cura, però, che la freccia stampata sulla cassa indichi la direzione del fluido e che la parte filtrante sia rivolta verso il basso.
- 2) Qualora il raccoglitore venga installato verticalmente, se la giunzione avviene per incollaggio, fare attenzione a che il collante non coli all'interno della cassa danneggiando così le parti interne. Per una corretta giunzione vedere le apposite istruzioni nel manuale "Elementi d'installazione".
- 3) Per evitare danneggiamenti alla retina, inserire sull'impianto apparecchiature atte ad evitare l'inversione del flusso.

Connection to the system

- 1) The strainer may be installed in any position in the pipeline with the arrow on the body in the direction of the line flow and with the bonnet suspended downwards.
- 2) When installing the strainer on a vertical line by solvent welding, extreme care must be taken to ensure that no solvent runs into the body as this would severely damage the internal parts and render the strainer inoperative. For correct jointing procedure refer to "Installation section".
- 3) To eliminate any possible damage to the filter screen, pipeline design should ensure that reverse flow conditions cannot occur.

Montage sur l'installation

- 1) Le filtre peut être installé dans n'importe quelle position horizontale aussi bien que verticale, en ayant soin que la flèche moulée sur le corps indique la direction du flux et que l'élément filtrant (tamis) soit orienté vers le bas.
- 2) Chaque fois que le filtre sera installé verticalement, si la jonction est effectuée par collage, il faudra avoir soin que la colle ne coule pas à l'intérieur du corps. Pour une jonction correcte, voir les instructions sur le manuel "Éléments d'installation".
- 3) Afin de ne pas abîmer le tamis il est opportun d'insérer sur l'installation un appareillage apte à éviter l'inversion du flux.

Einbau in einer Leitung

- 1) Schmutzfänger können in waagerechte und senkrechte Leitungen eingebaut werden.
- 2) Wenn der Schmutzfänger senkrecht montiert wird und die beiden Anschlußteile auf die Rohrleitung geklebt werden, dann aufpassen, dass kein Klebstoff in den Ventilkörper fließt, da dieser die Innerteile schwer schaden würde. Für einen korrekten Einbau, bitte die "Verbindungstechnik für das PVC-U Programm" folgen.
- 3) Achtung! Beim Einbau ist auf die Durchflußrichtung (Pfeil) zu achten und der Siebteil muß nach unten gerichtet sein. Ein Durchfluß in entgegengesetzter Richtung ist zu vermeiden, da das Filternetz zerstört werden kann.

Smontaggio**FIG. A-C**

- 1) Isolare il raccoglitore dal flusso del liquido e svuotare l'impianto a monte dello stesso
- 2) Svitare la ghiera (7) e separare il coperchio-supporto (3-4) dalla cassa (1)
- 3) Sfilare la rondella di fondo (6) dal coperchio-supporto (3-4)
- 4) Estrarre l'anello aperto (8) e separare la ghiera (7) dal coperchio (3)
- 5) Estrarre l'O-ring di tenuta del coperchio (5)

FIG. B

- 1) Isolare il raccoglitore dal flusso del liquido e svuotare l'impianto a monte dello stesso
- 2) Svitare il coperchio (3) ed estrarlo dalla cassa (1)
- 3) Sfilare il supporto (4) dal coperchio (3)
- 4) Sfilare la rondella (6) dal coperchio (3) e l'O-Ring (5) dalla sua sede nella cassa

Disassembly**FIG. A-C**

- 1) Isolate the strainer from the line flow and drain down the entire upstream system
- 2) Unscrew the lock nut (7) and separate the bonnet assembly (3-4) from the body (1)
- 3) Remove the retaining ring (6) from the screen support (3-4)
- 4) Remove the split ring (8) to release the bonnet (3) from the lock nut (7)
- 5) Remove the bonnet sealing ring (5)

FIG. B

- 1) Isolate the strainer from the line flow and drain down the entire upstream system
- 2) Unscrew the bonnet (3) from the body (1)
- 3) Remove the screen support housing (4) from the bonnet (3)
- 4) Remove the retaining ring (6) from the bonnet and the O-Ring seal (5) from its seat in the body (1)

Démontage**FIG. A-C**

- 1) Isolez le filtre du fluide et vidangez l'installation en amont de celui-ci
- 2) Dévissez la douille (7) et séparez le couvercle-support (3-4) du corps (1)
- 3) Retirez la rondelle (6) du couvercle-support (3-4)
- 4) Extrayez la bague ouverte (8) et séparez la douille (7) du couvercle (3)
- 5) Extrayez l'O-ring d'étanchéité (5) du couvercle (3).

FIG. B

- 1) Isolez le filtre du flux du liquide et vidangez la canalisation en amont
- 2) Dévissez le bouchon (3) qui doit être séparé du corps (1)
- 3) Retirez le support (4) du bouchon (3)
- 4) Retirez le support (4) de son logement dans le corps (1)
- 5) Retirez la rondelle (6) du bouchon (3) et le joint O-ring (5) de son logement dans le corps (1)

Demontage**FIG. A-C**

- 1) Die Leitung ist an geeigneter Stelle drucklos zu machen und zu entleeren
- 2) Nach dem Lösen der Überwurfmutter (7) kann das komplette Oberteil aus dem Gehäuse (1) gezogen werden
- 3) Danach ist der Haltering (6) vom Oberteil (3) zu entfernen
- 4) Der Haltering (8) ist vom Oberteil (3) abzuziehen, die Überwurfmutter wird hierdurch frei
- 5) Die O-Ring-Dichtung (5) kann jetzt entfernt werden

FIG. B

- 1) Die Leitung ist an geeigneter Stelle drucklos zu machen und zu entleeren
- 2) Das Unterteil (3) wird aus dem Gehäuse (1) herausgedreht
- 3) Das Einsteckteil (4) wird aus dem Unterteil (3) herausgezogen
- 4) Der Haltering (6) wird herausgenommen, das Filternetz (2) kann entfernt werden

RV PVC-U

Montaggio

FIG. A-C

- 1) Inserire l'O-ring (5) nella sua sede sul coperchio (3)
- 2) Infilare il coperchio (3) nella ghiera (7) e fissare i due componenti per mezzo dell'anello aperto (8)
- 3) Infilare nel coperchio-supporto (3-4) la retina (2) e assicurarla con la rondella di fondo (6)
- 4) Inserire il coperchio (3) nella cassa (1) ed avvitare la ghiera (7)

FIG. B

- 1) Inserire l'O-Ring (5) nel corpo (1)
- 2) Inserire la rondella (6) nel coperchio (3)
- 3) Inserire la retina (2) nel suo supporto (4)
- 4) Inserire il supporto (4) nel coperchio (3)
- 5) Avvitare il coperchio (3) nella cassa (1)

Le operazioni di manutenzione possono essere effettuate con il corpo valvola installato. Per effettuare queste operazioni è consigliabile lubrificare con olii e grassi idonei le parti soggette ad usura; a tale proposito si ricorda la non idoneità all'uso degli oli minerali, in quanto aggressivi per la gomma etilene-propilene.

AVVERTENZE

- I raccoglitori con cassa trasparente permettono il passaggio della luce provocando la crescita di alghe e microrganismi al loro interno
- I raccoglitori con cassa trasparente non sono protetti dall'irraggiamento solare. Un utilizzo in impianti all'aperto accelera il processo di invecchiamento del materiale riducendone il tempo di vita
- Si raccomanda di proteggere i raccoglitori con cassa trasparente da sollecitazioni vibrazionali in prossimità dei gruppi di pompaggio
- Verificare sempre la pulizia degli elementi filtranti

Assembly

FIG. A-C

- 1) Fit the O-ring (5) into the groove on the bonnet (3)
- 2) Slip the lock nut (7) over the bonnet and fix it in its position by snapping the split ring (8) into the top groove on the bonnet (3)
- 3) Insert the filter screen (2) into the screen housing (3-4) and secure it with the retaining ring (6)
- 4) Insert the bonnet (3) into the body (1) and screw the lock nut (7)

FIG. B

- 1) Fit the O-Ring seal (5) into the body (1)
- 2) Fit the retaining ring (6) into the bonnet (3) with the cone shaped part upwards
- 3) Insert the filter screen (2) in the screen support housing (4)
- 4) Insert the screen support housing (4) into the bonnet (3)
- 5) Screw the bonnet assembly into the body (1)

Maintenance operations may be carried out with the strainer body in line. During maintenance operations it is advisable to lubricate the rubber seals with grease. Do not use mineral oils as they attack EPDM rubber.

WARNING

- The sediment strainers with transparent body permit the light to come in causing the growth of seaweed and micro-organisms
- The sediment strainers with transparent body are not protected against sun radiation. An open air use increases the ageing of the material and makes its lifetime shorter
- The sediment strainers with transparent body must be protected against vibrating stresses in proximity to pumping stations
- Always check the cleanness of the filtering elements

Montage

FIG. A-C

- 1) Placez l'O-ring (5) dans son logement sur le couvercle-support (3)
- 2) Insérez le couvercle-support (3) dans la douille (7) et fixez les deux éléments au moyen de la bague ouverte (8)
- 3) Insérez le tamis (2) dans le support (3-4)
- 4) Insérez le couvercle (3) dans le corps (1) et vissez la douille (7)

FIG. B

- 1) Insérez le joint O-ring (5) dans le corps (1)
- 2) Insérez la rondelle (6) dans le bouchon (3)
- 3) Insérez le tamis (2) dans son support (4)
- 4) Insérez le support (4) dans le bouchon (3)
- 5) Vissez le bouchon (3) dans le corps (1)

Les opérations d'entretien peuvent être effectuées avec le corps du filtre installé. Pour effectuer ces opérations, il est conseillé de lubrifier les éléments sujets à usure avec de l'huile. Il ne faut jamais utiliser des huiles minérales, étant agressifs pour le caout-chouc éthylène-propylène.

ATTENTION

- Les filtres à tamis avec corps transparent permettent au soleil de faciliter la formation de micro organismes
- Les filtres à tamis ne sont pas protégés par les rayons solaires. Une utilisation en plein air accélère le vieillissement des matériaux
- On recommande de protéger les filtres à tamis avec corps transparent des vibrations causées par les stations de pompage
- Nettoyer souvent les éléments du filtre

Montage

FIG. A-C

- 1) Der O-Ring (5) ist in die Nut des Oberteils (3) einzubringen
- 2) Nach dem Aufstecken der Überwurfmutter (7) auf das Oberteil (3) wird der Haltering (8) in die entsprechende Nut eingesetzt
- 3) Danach ist das Filternetz (2) auf das Oberteil (3-4) einzusetzen und mit dem Ring (6) zu fixieren
- 4) Das Kpl. Oberteil kann nun in das Gehäuse (1) gesteckt und mit der Überwurfmutter angezogen werden

FIG. B

- 1) Der O-Ring (5) wird in die Gehäuse-Nut eingelegt
- 2) Der Haltering (6) wird mit dem konischen Teil nach außen in das Unterteil (3) eingelegt
- 3) Das Filternetz (2) wird in das Einsteckteil (4) geschoben
- 4) Das Einsteckteil (4) wird nun in das Unterteil (3) gesteckt
- 5) Die komplette Einheit wird nun in das Gehäuse (1) geschraubt und festgezogen.

Wartungsarbeiten können bei eingebautem Schmutzfänger durchgeführt werden. Bei der Montage werden die Dichtungen zweckmäßigerweise leicht mit Gummischmiermittel eingestrichen. Mineralenschmiermitteln sind nicht empfohlen, da sie den EPDM Gummi beschädigen.

BEMERKUNG

- Schmutzfänger mit transparentem Gehäuse ermöglichen einen Lichteinfall in die Rohrleitung und hierdurch das Wachsen von Micro-Organismen
- Schmutzfänger mit transparentem Gehäuse sind nicht gegen Sonneneinstrahlung geschützt. Eine Freiluftinstallation beschleunigt die Alterung und verkürzt die Standzeit
- Schmutzfänger mit transparentem Gehäuse müssen gegen Vibration geschützt werden, besonders in Pumpenstationen.
- Der Verschmutzungsgrad der Filternetze ist regelmäßig zu überprüfen.



RV PVC-U

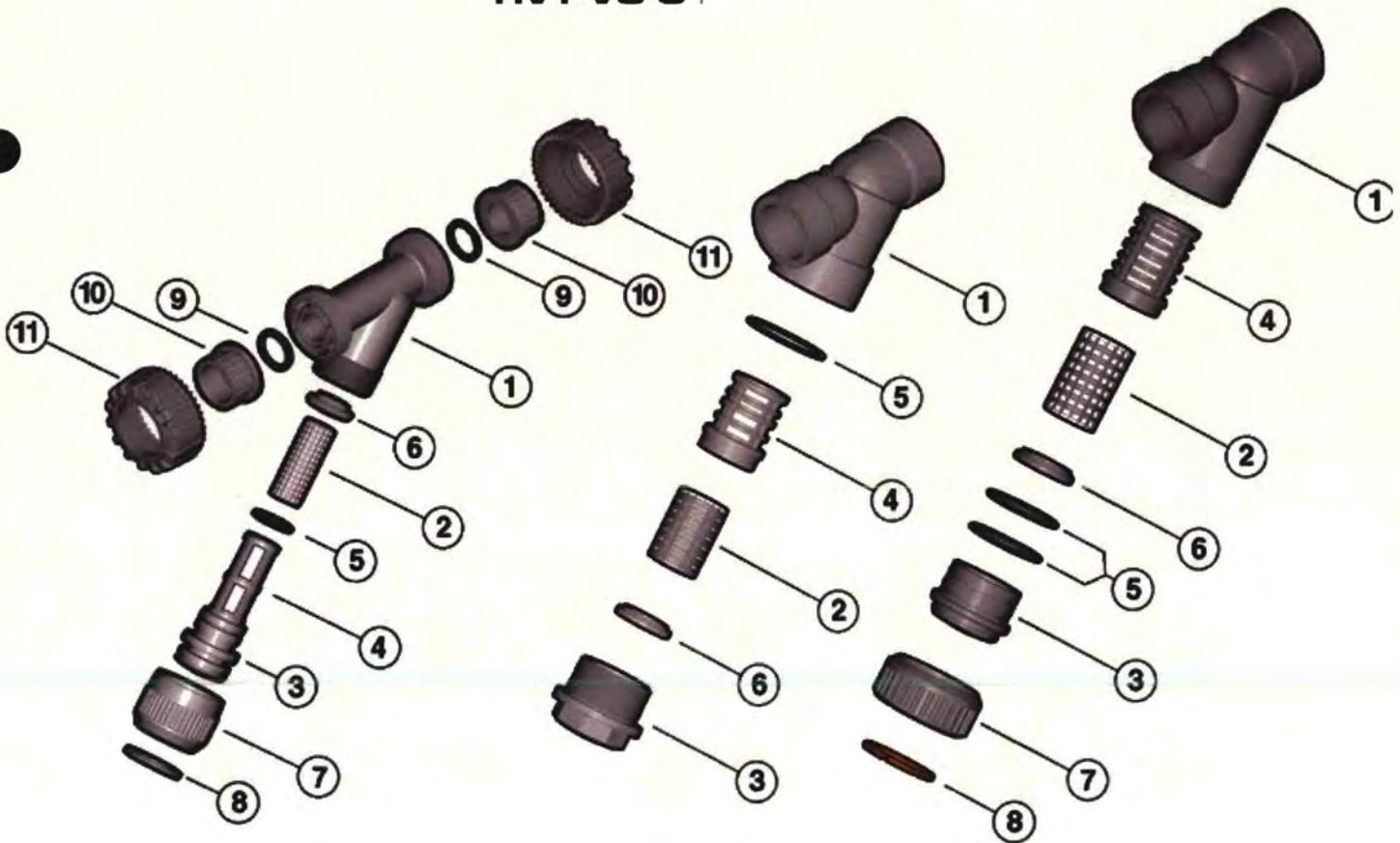


Fig. A (DN 15 ÷ 50)

Fig. B (DN 65 ÷ 80)

Fig. C (DN 100)

Pos.	Componenti	Materiale
1	Cassa	PVC-U
*2	Retina	PVC/inox
3	Coperchio	PVC-U
4	Supporto retina	PVC-U
*5	Guarnizione toroidale	EPDM/FPM
6	Rondella	PVC-U
7	Ghiera	PVC-U
8	Anello Aperto	PVC-U
*9	Guarnizione O-Ring tenuta di testa	EPDM/FPM
*10	Manicotto	PVC-U
11	Ghiera	PVC-U

* parti di ricambio

Pos.	Composants	Materiaux
1	Corps	PVC-U
*2	Tamis	PVC/inox
3	Bouchon	PVC-U
4	Support tamis	PVC-U
*5	Joint O-Ring	EPDM/FPM
6	Rondelle	PVC-U
7	Douille	PVC-U
8	Bague ouverte	PVC-U
*9	Joint du collet	EPDM/FPM
*10	Collet	PVC-U
11	Écrou union	PVC-U

* pièce de rechange

Pos.	Components	Material
1	Body	PVC-U
*2	Screen	PVC/SS
3	Bonnet	PVC-U
4	Screen support housing	PVC-U
*5	O-Ring seal	EPDM/FPM
6	Retaning ring	PVC-U
7	Lock nut	PVC-U
8	Split ring	PVC-U
*9	Socket seal O-Ring	EPDM/FPM
*10	End connector	PVC-U
11	Union-nut	PVC-U

* spare parts

Pos.	Benennung	Werkstoff
1	Gehäuse	PVC-U
*2	Filternetz	PVC/Edelstahl
3	Unterteil	PVC-U
4	Einsteckteil	PVC-U
*5	Gehäusedichtung	EPDM/FPM
6	Haltering	PVC-U
7	Überwurfmutter	PVC-U
8	Haltering	PVC-U
*9	O-Ring	EPDM/FPM
*10	Anschlußteile	PVC-U
11	Überwurfmutter	PVC-U

* Ersatzteile

Cod

RVAT pag. 203

d	EPDM
3"	RVAT300E
4"	RVAT400E

RVDV - RVDT pag. 204

d	RVDV - EPDM	RVDT - EPDM
16	RVDV016E	RVDT016E
20	RVDV020E	RVDT020E
25	RVDV025E	RVDT025E
32	RVDV032E	RVDT032E
40	RVDV040E	RVDT040E
50	RVDV050E	RVDT050E
63	RVDV063E	RVDT063E

RVFV - RVFT pag. 202

R	RVFV - EPDM	RVFT - EPDM
2 1/2"	RVFV212E	RVFT212E
3"	RVFV300E	RVFT300E
4"	RVFV400E	RVFT400E

RVIV - RVIT pag. 201

d	RVIV - EPDM	RVIT - EPDM
75	RVIV075E	RVIT075E
90	RVIV090E	RVIT090E
110	RVIV110E	RVIT110E

RVNT pag. 203

R	EPDM
3"	RVNT300E
4"	RVNT400E

RVOV - RVOT pag. 204

d	RVOV - EPDM	RVOT - EPDM
20	RVOV020E	RVOT020E
25	RVOV025E	RVOT025E
32	RVOV032E	RVOT032E
40	RVOV040E	RVOT040E
50	RVOV050E	RVOT050E
63	RVOV063E	RVOT063E
75	RVOV075E	RVOT075E
90	RVOV090E	RVOT090E
110	RVOV110E	RVOT110E

RVUAT pag. 202

R	EPDM
3/8"	RVUAT038E
1/2"	RVUAT012E
3/4"	RVUAT034E
1"	RVUAT100E
1 1/4"	RVUAT114E
1 1/2"	RVUAT112E
2"	RVUAT200E

RVUFV - RVUFT pag. 202

R	RVUFV - EPDM	RVUFT - EPDM
3/8"	RVUFV038E	RVUFT038E
1/2"	RVUFV012E	RVUFT012E
3/4"	RVUFV034E	RVUFT034E
1"	RVUFV100E	RVUFT100E
1 1/4"	RVUFV114E	RVUFT114E
1 1/2"	RVUFV112E	RVUFT112E
2"	RVUFV200E	RVUFT200E

RVUIV - RVUIT pag. 201

d	RVUIV - EPDM	RVUIT - EPDM
16	RVUIV016E	RVUIT016E
20	RVUIV020E	RVUIT020E
25	RVUIV025E	RVUIT025E
32	RVUIV032E	RVUIT032E
40	RVUIV040E	RVUIT040E
50	RVUIV050E	RVUIT050E
63	RVUIV063E	RVUIT063E

RVUNT pag. 203

R	EPDM
3/8"	RVUNT038E
1/2"	RVUNT012E
3/4"	RVUNT034E
1"	RVUNT100E
1 1/4"	RVUNT114E
1 1/2"	RVUNT112E
2"	RVUNT200E



APPENDIX 14

CASITAN Sdn Bhd

(Activated Carbon Company) Co. Reg. 396388U

20C, Jalan Petaling Utama 8, 7th Miles Off Jalan Klang Lama, 46000 Petaling Jaya, Malaysia

Telephone: 603-7785 1245, 7785 1246 Fax: 603-7785 1252 E-Mail: casitan@tm.net.my

PELLETIZED COAL BASED ACTIVATED CARBON KI IMPREGNATED

TYPICAL SPECIFICATION

TYPICAL ANALYSIS	U.O.M	PODUCT CODE
		PEACC60KI
H2S CAPACITY (min.)	H2S/cc	0.14
KI CONTENT	%	2%
CTC ADSORPTION (base carbon)	%	60
BULK DENSITY	gm/cc	0.48 - 0.54
MOISTURE (max.)	%	15
ASH	%	9 - 12
HARDNESS (min.)	%	97

This is a pelletised virgin activated carbon impregnated with KI made especially for use in a vapor application. It is suitable for the optimum adsorption of H₂S & other contaminants from gas flow. It's particle size and pore structure has been specially designed to provide the best adsorption of impurities from vapor stream with the least flow resistance.

This product is processed from a mixture of selected anthracite and sub-bituminous coal and activated at high temperature with steam and impregnated with KI.

SIZE : 4mm diameter cylindrical pellets

PACKING : 125kg Metal drum or 500 kg PP bulk bag

c:KI-D4

Date: Feb 01, 2008

APPENDIX 15



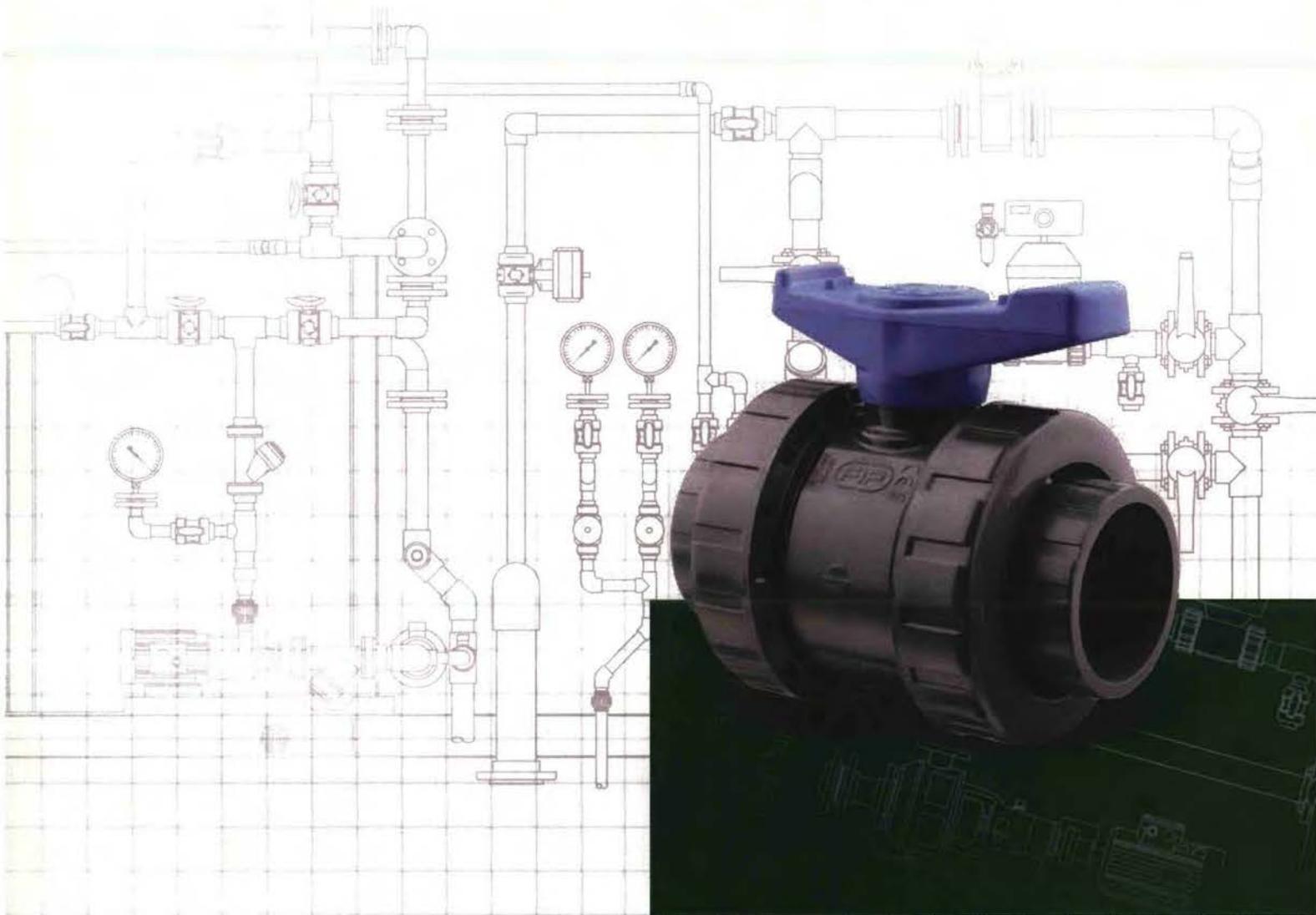
Valvola a sfera a due vie

2-way ball valve

**Robinet à tournant sphérique
à 2 voies**

2-Wege-Kugelhahn

VE PVC-U



VE PVC-U

I dati del presente prospetto sono forniti in buona fede. La FIP non si assume alcuna responsabilità su quei dati non direttamente derivati da norme internazionali.
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VE PVC-U

Valvola a sfera a due vie

- Gamma dimensionale da d 16 mm a d 110 mm, da R 3/8" a R 4"
- Sistema di giunzione per incollaggio e per filettatura
- Resistenza a pressioni di esercizio fino a 16 bar a 20° C; per il dettaglio vedere pagina seguente
- Facile disinserimento radiale dall'impianto e conseguente rapida sostituzione degli O-ring e delle guarnizioni della sfera senza l'impiego di alcun attrezzo
- Ingombro ridotto
- Possibilità di smontaggio delle tubazioni a valle con la valvola in posizione di chiusura
- Nuovo sistema di tenuta
- Maniglia ergonomica bipozionabile con chiave di registro tenuta
- Idoneità del PVC-U impiegato a venire in contatto con acqua potabile ed altre sostanze alimentari secondo le leggi vigenti
- Per maggiori informazioni visitare il sito: www.fipnet.it

2-way ball valve

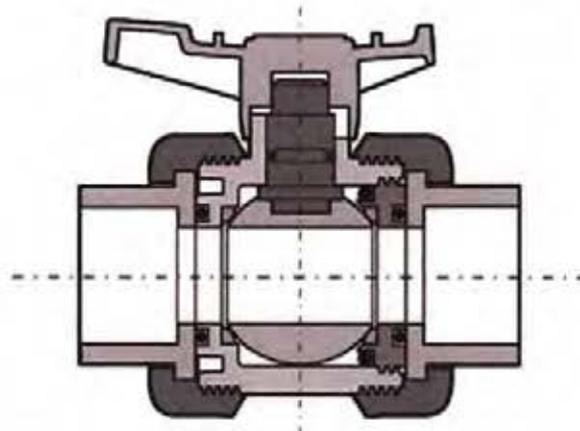
- Size range from d 16 mm up to d 110 mm and from R 3/8" up to R 4"
- Jointing by solvent welding or threaded connections
- Maximum working pressure: 16 bar at 20° C; for full details see following page
- Easy removal of the valve body from the system, allowing quick replacement of O-rings and ball seats without additional equipment
- Compact design
- In the closed position the pipeline can be disconnected downstream from the valve without leakage
- New seat and seal design
- Block with adjustment of ball seal
- Ergonomic handle with seal adjustment key
- FIP PVC-U is suitable for conveying foodstuffs and drinking water and meets the necessary standards and regulations
- For more information please visit our website: www.fipnet.it

Robinet à tournant sphérique à 2 voies

- Gamme dimensionnelle de d 16 mm à d 110 mm, de R 3/8" à R 4"
- Jonction par collage aussi bien que par filetage
- Pression de service jusqu'à 16 bar à 20° C; pour les détails voir page suivante
- Démontage radial du corps du robinet qui permet un remplacement rapide des joints O-ring et des autres garnitures, sans utiliser aucun outil
- Encombrement minimal
- En position fermée, le robinet permet le démontage de l'installation en aval par rapport à la direction du flux
- Conception de nouveaux sièges et points d'étanchéité
- Système réglable de blocage de la sphère
- Volant ergonomique avec clef de réglage de l'étanchéité
- PVC-U de qualité alimentaire apte à l'utilisation avec l'eau potable et les aliments suivant les règlements en vigueur
- Pour avoir d'autres informations, visiter le site: www.fipnet.it

2-Wege-Kugelhahn

- Größen von d 16 mm bis d 110 mm und von R 3/8" bis R 4"
- Mit Klebe- oder Gewindeanschlüssen
- Der maximale Betriebsdruck beträgt 16 bar bei 20° C. Weitere Einzelheiten auf folgende Seite
- Der einfache Ausbau der Armatur aus dem Leitungssystem erlaubt den schnellen Wechsel von O-Ringen oder Kugelsitzen ohne zusätzliches Werkzeug
- Kompakte Bauform
- In geschlossener Stellung des Kugelhahns kann die drucklose Seite der Leitung gelöst werden
- Neues Sitz- und Dichtungskonzept. Die Kugelabdichtung ist durch eine Micro-Justierung frei von Rohrleitungskräften
- Ergonomischer Handgriff mit integriertem Montage- und Einstellwerkzeug
- FIP PVC-U entspricht den geltenden Vorschriften und ist für Trinkwasser oder andere für den Verzehr bestimmte Medien zugelassen
- Für weitere Details schauen Sie auf unsere Website: www.fipnet.it



Legenda

d	diametro nominale esterno del tubo in mm	d	nominal outside diameter of the pipe in mm	d	diamètre extérieur nominal du tube en mm	d	Rohraußendurchmesser, mm
DN	diametro nominale interno in mm	DN	nominal internal diameter in mm	DN	diamètre nominal intérieur en mm	DN	Nennweite, mm
R	dimensione nominale della filettatura in pollici	R	nominal size of the thread in inches	R	dimension nominale du filetage en pouces	R	Gewinde (DIN 2999, T1)
PN	pressione nominale in bar (pressione max di esercizio a 20° C - acqua)	PN	nominal pressure in bar (max. working pressure at 20° C - water)	PN	pression nominale en bar (pression de service max à 20° C - eau)	PN	Nennndruck, bar (max Betriebsdruck bei 20° C Wasser)
g	peso in grammi	g	weight in grams	g	poids en grammes	g	Gewicht in Gramm
PVC-U	cloruro di polivinile rigido	PVC-U	unplasticized polyvinyl chloride	PVC-U	polychlorure de vinyle non plastifié	PVC-U	Polyvinylchlorid, hart ohne Weichmacher
HIPVC	PVC alto impatto	HIPVC	high impact PVC	HIPVC	PVC haut impact	HIPVC	hoch Einschlag
CR	gomma cloroprene	CR	chloroprene rubber	CR	polychloroprène	CR	Polychloropren
PE	polietilene	PE	polyethylene	PE	polyéthylène	PE	Polyethylen
s	spessore tubo in mm	s	wall thickness, mm	s	épaisseur du tube, mm	s	Wandstärke, mm
SDR	standard dimension ratio = d/s	SDR	standard dimension ratio = d/s	SDR	standard dimension ratio = d/s	SDR	standard dimension ratio = d/s

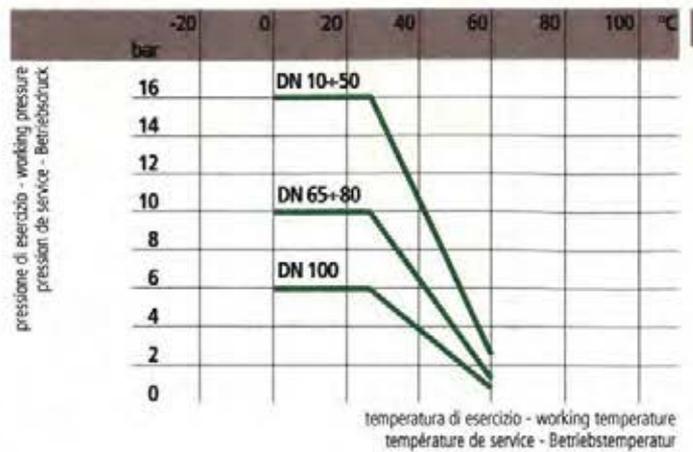
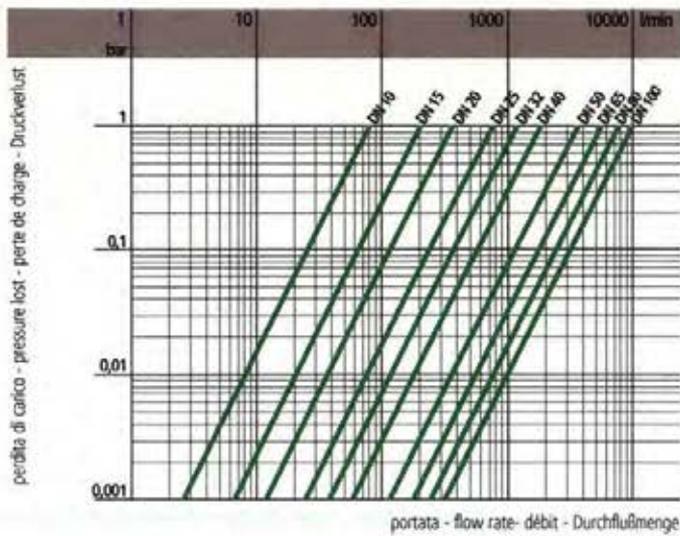
VE PVC-U

**Dati
Tecnici**

**Technical
Data**

**Données
Techniques**

**Technische
Daten**



d	16	20	25	32	40	50	63	75	90	110
DN	10	15	20	25	32	40	50	65	80	100
k_{v100}	80	200	385	770	1100	1750	3400	5250	7100	9500

1 Diagramma delle perdite di carico

Pressure loss chart

Table de perte de charge

Druckverlust-Diagramm

2 Variazione della pressione in funzione della temperatura per acqua o fluidi non pericolosi nei confronti dei quali il PVC-U è classificato CHIMICAMENTE RESISTENTE. Vedere il prospetto "Guida alla resistenza chimica". In altri casi è richiesta un'adeguata diminuzione della pressione nominale PN. 50 anni secondo DIN 3441

Pressure/temperature rating for water and harmless fluids to which PVC-U is RESISTANT. See "A guide to chemical resistance". In other cases a reduction of the rated PN is required. 50 years according to DIN 3441

Variation de la pression en fonction de la température pour l'eau et les fluides non agressifs pour lequel le PVC-U est considéré CHIMIQUEMENT RESISTANT. Voir "Guide de résistance chimique". Pour les autres cas une diminution du PN est nécessaire. 50 années selon DIN 3441

Druck/Temperatur-Diagramm für Wasser und ungefährliche Medien gegen die PVC-U beständig ist. Siehe Beständigkeitsliste. In allen anderen Fällen ist eine entsprechende Reduzierung der Druckstufe erforderlich. 50 Jahre nach DIN 3441

3 Coefficiente di flusso k_{v100}
Per coefficiente di flusso k_{v100} si intende la portata Q in litri al minuto di acqua a 20° C che genera una perdita di carico Δp = 1 bar per una determinata apertura della valvola. I valori k_{v100} indicati in tabella si intendono per valvola completamente aperta

Flow coefficient k_{v100}
k_{v100} is the number of litres per minute of water at a temperature of 20° C that will flow through a valve with a one-bar pressure differential at a specified rate. The k_{v100} values shown in the table are calculated with the valve completely open

Coefficient de débit k_{v100}
k_{v100} est le nombre de litres par minute d'eau, à une température de 20° C, qui s'écoule dans une vanne de régulation avec une pression différentielle de 1 bar à une vitesse donnée. Les valeurs k_{v100} indiquées sur la table sont évaluées lorsque le robinet est entièrement ouvert

k_{v100}-Werte
Der k_{v100} - Wert nennt den Durchsatz in l/min für Wasser bei 20° C und einem Δp von 1 bar bei völlig geöffnetem Ventil

VE PVC-U

Dimensioni

La FIP ha approntato una gamma di valvole a sfera, i cui attacchi sono in accordo con le seguenti norme:
 Incollaggio: ISO 727, UNI EN 1452, DIN 8063, NF T54-028, BS 4346/1, accoppiabili con tubi secondo ISO 161/1, UNI EN 1452, DIN 8062, NF T54-016, BS 3506, BS 3505.
 Filettatura: UNI ISO 228/1, DIN 2999, BS 21

Dimensions

FIP have produced a complete range of ball valves whose couplings comply with the following standards:
 Solvent welding: ISO 727, UNI EN 1452, DIN 8063, NF T54-028, BS 4346/1 coupling to pipes complying with ISO 161/1, UNI EN 1452, DIN 8062, NF T54-016, BS 3506, BS 3505.
 Threaded couplings: UNI ISO 228/1, DIN 2999, BS 21.

Dimensions

FIP a réalisé une gamme complète de robinet à tournant sphérique dont les embouts sont conformes aux normes suivantes:
 Collage: ISO 727, UNI EN 1452, DIN 8063, NF T54-028, BS 4346/1 assemblés avec des tubes selon ISO 161/1, UNI EN 1452, DIN 8062, NF T54-016, BS 3506, BS 3505.
 Filetage: UNI ISO 228/1, DIN 2999, BS 21.

Dimensionen

Die Kugelhahnreihe entspricht mit ihren Anschlußmöglichkeiten folgenden Normen:
 Klebeanschluß: ISO 727, UNI EN 1452, DIN 8063, NF T 54-028, BS 4346/1 für Rohre nach ISO 161/1, UNI EN 1452, DIN 8062, NF T 54-016, BS 3506, BS 3505.
 Gewindeverbindung: UNI ISO 228/1, DIN 2999, BS 21.

VEIV

VALVOLA A SFERA
 con attacchi femmina per incollaggio, serie metrica

BALL VALVE
 with metric series plain female ends for solvent welding

ROBINET À TOURNANT SPHÉRIQUE
 avec embouts femelles à coller, série métrique

KUGELHAHN
 mit Klebemuffen
 21.541.24



	d	DN	PN	L	Z	H	E	B	C	g
R	16	10	16	14	54	82	53	50	65	150
R	20	15	16	16	50	82	53	50	65	145
R	25	20	16	19	53	91	62	58	76	220
R	32	25	16	22	59	103	71	65	85	315
R	40	32	16	26	68	120	84	76	100	505
R	50	40	16	31	77	139	98	85	112	725
R	63	50	16	38	98	174	117	103	137	1245
R	75	65	10	44	128	216	154	133	222	2600
R	90	80	10	51	142	244	189	154	270	4330
R	110	100	6	61	187	309	221	175	270	7450

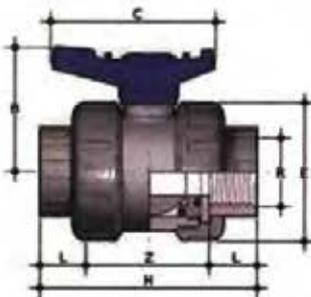
VEFV

VALVOLA A SFERA
 con attacchi femmina, filettatura cilindrica gas

BALL VALVE
 with BS parallel threaded female ends

ROBINET À TOURNANT SPHÉRIQUE
 avec embouts femelles, filetage cylindrique gaz

KUGELHAHN
 mit Gewindemuffen
 21.541.14



	R	DN	PN	L	Z	H	E	B	C	g
R	3/8"	10	16	11,4	59,2	82	53	50	65	150
R	1/2"	15	16	15	60	90	53	50	65	145
R	3/4"	20	16	16,3	60,4	93	62	58	76	220
R	1"	25	16	19,1	71,8	110	71	65	85	315
R	1 1/4"	32	16	21,4	84,2	127	84	76	100	505
R	1 1/2"	40	16	21,4	88,2	131	98	85	112	725
R	2"	50	16	25,7	109,6	161	117	103	137	1245
R	2 1/2"	65	10	30,2	155,6	216	154	133	222	2600
R	3"	80	10	33,3	175,4	242	189	154	270	4330
R	4"	100	6	39,3	230,4	309	221	175	270	7450

R = RINA dich. n. MAC/36401/TO/01

VE PVC-U

VELV

VALVOLA A SFERA
con attacchi femmina per
incollaggio, serie BS

BALL VALVE
with BS series plain female ends for
solvent welding

ROBINET À TOURNANT SPHÉRIQUE
avec embouts femelles à coller, série
BS

KUGELHAHN
mit Klebemuffen nach BS



d	DN	PN	L	Z	H	E	B	C	g
1/2"	15	16	16,5	49	82	53	50	65	145
3/4"	20	16	19	53	91	62	58	76	220
1"	25	16	22,5	58	103	71	65	85	315
1 1/4"	32	16	26	68	120	84	76	100	505
1 1/2"	40	16	30	79	139	98	85	112	725
2"	50	16	36	102	174	117	103	137	1245
2 1/2"	65	10	44	128	216	154	133	222	2600
3"	80	10	51	142	244	189	154	270	4330
4"	100	6	63	183	309	221	175	270	7450

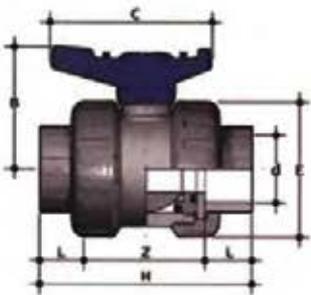
VEAV

VALVOLA A SFERA
con attacchi femmina per incollaggio,
serie ASTM

BALL VALVE
with ASTM series plain female ends
for solvent welding

ROBINET À TOURNANT SPHÉRIQUE
avec embouts femelles à coller,
série ASTM

KUGELHAHN
mit ASTM Klebemuffen



d	DN	PN	L	Z	H	E	B	C	g
1/2"	15	16	22,5	51	96	53	50	65	145
3/4"	20	16	25,5	54	105	62	58	76	220
1"	25	16	28,7	59,5	117	71	65	85	315
1 1/4"	32	16	32	72	136	84	76	100	505
1 1/2"	40	16	35	77	147	98	85	112	725
2"	50	16	38,2	97,6	174	117	103	137	1245
2 1/2"	65	10	44,5	127	216	154	133	222	2600
3"	80	10	48	139	235	189	154	270	4330
4"	100	6	57,5	194	309	221	175	270	7500

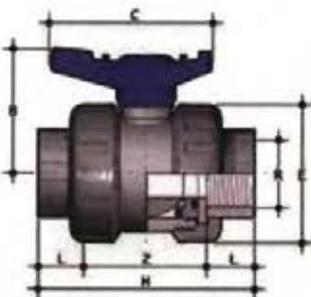
VENV

VALVOLA A SFERA
con attacchi femmina, filettatura NPT

BALL VALVE
with NPT threaded female ends

ROBINET À TOURNANT SPHÉRIQUE
avec embouts femelles, filetage NPT

KUGELHAHN
mit NPT Gewindemuffen



R	DN	PN	L	Z	H	E	B	C	g
3/8"	10	16	13,7	59,2	82	53	50	65	150
1/2"	15	16	17,8	60	90	53	50	65	145
3/4"	20	16	18	60,4	93	62	58	76	220
1"	25	16	22,6	71,8	110	71	65	85	315
1 1/4"	32	16	15,1	84,2	127	84	76	100	505
1 1/2"	40	16	24,7	88,2	131	98	85	112	725
2"	50	16	29,6	109,6	161	117	103	137	1245
2 1/2"	65	10	33,2	155,6	216	154	133	222	2600
3"	80	10	35,5	175,4	242	189	154	270	4330
4"	100	6	37,6	230,4	309	221	175	270	7450

VE PVC-U

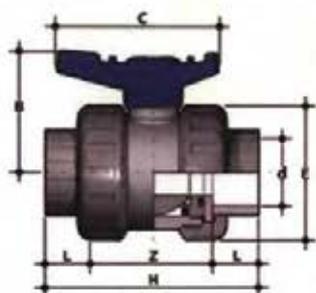
VEJV

VALVOLA A SFERA
con attacchi femmina per
incollaggio, serie JIS

BALL VALVE
with JIS series plain female ends for
solvent welding

ROBINET À TOURNANT SPHERIQUE
avec embouts femelles à coller, série
JIS

KUGELHAHN
mit JIS Klebemuffen



d	DN	PN	L	Z	H	E	B	C	g
1/2"	15	16	30	50	110	53	50	65	145
3/4"	20	16	35	53	123	62	58	76	220
1"	25	16	40	59	139	71	65	85	315
1 1/4"	32	16	44	70	156	84	76	100	505
1 1/2"	40	16	55	87	187	98	85	112	725
2"	50	16	63	112	223	117	103	137	1245
2 1/2"	65	10	61	146	248	154	133	222	2600
3"	80	10	64,5	164	268	189	154	270	4330
4"	100	6	84	190	358	221	175	270	7450

VEGV

VALVOLA A SFERA
con attacchi femmina filettatura JIS

BALL VALVE
with JIS threaded female ends

ROBINET À TOURNANT SPHERIQUE
avec emboufs femelles filetage JIS

KUGELHAHN
mit JIS Gewindemuffen



R	DN	PN	L	Z	H	E	B	C	g
1/2"	15	16	16	50	82	53	50	65	145
3/4"	20	16	19	53	91	62	58	76	220
1"	25	16	22	59	103	71	65	85	315
1 1/4"	32	16	25	70	120	84	76	100	505
1 1/2"	40	16	26	87	139	98	85	112	725
2"	50	16	31	112	174	117	103	137	1245
2 1/2"	65	10	35	146	216	154	133	222	2600
3"	80	10	40	164	244	189	154	270	4330
4"	100	6	45	219	309	221	175	270	7450

VE PVC-U

Accessori

Accessories

Accessoires

Zubehör

CVPV

MANICOTTI A PORTAGOMMA per valvola a sfera

HOSE ADAPTOR for ball valve

DOUILLES CANNELEES pour robinet à tournant sphérique

DRUCKSCHLAUSCHTÜLLE für Kugelhahn



d	DN	PN	P ₁	P ₂	H	B	C	g	Codice/Part number Code/Artikelnummer
50	40	16	50	52	246	85,5	112	840	CVPV050
63	50	16	60	64	273	103	137	1350	CVPV063

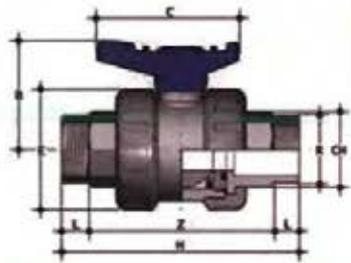
CVRV

MANICOTTI FILETTATI MASCHIO per valvole a sfera

THREADED MALE ENDS for ball valve

EMBOUT MALE FILETÉ pour robinet à tournant sphérique

GEWINDESTUTZEN für Kugelhahn



DN	R	PN	L	Z	H	E	B	C	CH	g	Codice/Part number Code/Artikelnummer
40	1 1/2	16	21,4	153,2	196	98	85,5	112	52	810	CVRV112
50	2	16	25,7	174,6	226	117	103	137	62	1300	CVRV200

CVDE

CONNETTORI IN PE100 codolo lungo, per giunzioni con manicotti elettrici o testa a testa SDR 11

END CONNECTOR IN PE100 long spigot, for electrofusion or butt welding SDR 11

EMBOUTS MALES EN PE100 pour soudure par électrofusion ou bout-à-bout SDR 11

ANSCHLÜBTEILE MIT LANGEM STUTZEN AUS PE100 zum Stumpf und Elektromuffenschweissen SDR11 034.447.312



d	DN	L	H	Codice/Part number Code/Artikelnummer
20	15	55	154	CVDE11020
25	20	70	186	CVDE11025
32	25	74	199	CVDE11032
40	32	78	217	CVDE11040
50	40	84	236	CVDE11050
63	50	91	268	CVDE11063
75	65	111	337	CVDE11075
90	80	118	364	CVDE11090
110	100	132	432	CVDE11110

VE PVC-U

Installazione sull'impianto

- 1) Svitare le ghiera (11) e inserirle sui tratti di tubo.
 - 2) Procedere all'incollaggio o avvitamento dei manicotti (7) sulle estremità dei tubi. Per una corretta giunzione vedere le apposite istruzioni nel manuale "Elementi d'installazione".
 - 3) Posizionare la valvola fra i manicotti verificando la coassialità tra tubo e valvola.
 - 4) Serrare la ghiera a valle rispetto alla direzione del fluido.
 - 5) Serrare progressivamente l'altra ghiera (11) in corrispondenza della scritta "REGOLARE" (a monte rispetto alla direzione del fluido) fino a raggiungere la perfetta tenuta della valvola.
 - 6) **Attenzione:**
 - qualora sia previsto un collaudo ad alta pressione posizionare sempre la valvola con la ghiera in corrispondenza della scritta "REGOLARE-ADJUST"
 - a monte rispetto alla direzione del fluido.
 - non utilizzare aria compressa o altri gas per il collaudo delle linee termoplastiche.
 - in posizione di chiusura, la valvola non deve essere sottoposta a pressioni di collaudo maggiori delle massime pressioni di esercizio (vedi "Dati Tecnici", grafico nr. 3).
- In caso di utilizzo di liquidi volatili come per esempio Idrogeno Perossido (H₂O₂) o Ipoclorito di Sodio (NaClO) si consiglia per ragioni di sicurezza di contattare il servizio tecnico. Tali liquidi, vaporizzando, potrebbero creare pericolose sovrappressioni nella zona tra cassa e sfera.

Evitare sempre brusche manovre di chiusura e proteggere la valvola da manovre accidentali.

Connection to the system

- 1) Unscrew the union nuts (11) and slide them onto the pipe.
- 2) Solvent weld or screw the valve end connectors (7) onto the pipe ends. For correct jointing procedure refer to our section on "Installation".
- 3) Position the valve between the two end connectors.
- 4) Tighten the union nut on the downstream side of the valve.
- 5) Tighten the union nut on the upstream side (marked "ADJUST") to achieve an optimum valve operation with perfect sealing on valve seats.
- 6) **Caution:**
 - When testing under high pressure levels, the "REGOLARE-ADJUST" mark on the valve must be installed facing upstream**
 - do not test thermoplastic piping systems with compressed air or gases.
 - when testing thermoplastic piping systems do not exceed the operating pressure of the valves used in close position (see "Technical Data", chart nr. 3).

• For safety reasons please contact the technical service when using volatile liquids such as hydrogen peroxide (H₂O₂) and Sodium Hypochlorite (NaClO). These liquids may vaporize with a dangerous pressure increase in the dead space between the ball and the body.

It is important to avoid rapid closure of valves to eliminate the possibility of water hammer causing damage to the pipeline.

Montage sur l'installation

- 1) Dévissez les écrous-unions (11) et insérez-les sur les tubes.
- 2) Procédez au collage ou vissez les collets (7) de raccordement sur les tubes. Pour un assemblage correct, voir les instructions sur le manuel "Eléments d'installation".
- 3) Insérez le robinet entre les deux collets.
- 4) Serrez l'écrou en aval par rapport à la direction du flux.
- 5) Serrez l'autre écrou (11) progressivement, à l'endroit où se trouve l'inscription "REGLAGÉ" (en amont par rapport à la direction du flux) jusqu'au moment où l'on a une parfaite étanchéité du robinet.
- 6) **Attention: En cas d'essai à haute pression positionner le robinet avec l'écrou située en correspondance avec l'inscription "REGOLARE-ADJUST"**
 - en amont par rapport à la direction du flux.
 - ne pas utiliser air comprimé ou autres gaz pour l'essai de la ligne.
 - en position de fermeture le robinet ne doit pas être soumis à une pression de test supérieure à la pression de service maximale (voir "Données Techniques", graf. nr. 3).

• Pour raisons de sûreté nous vous prions de contacter le service technique en cas de fluides volatiles comme hydrogène peroxyde (H₂O₂) et Sodium Hypochlorite (NaClO). Les liquides peuvent vaporiser avec une dangereuse augmentation de la pression entre la sphère et le corps.

Il est important d'éviter toujours la fermeture trop rapides des vannes.

Einbau in eine Leitung

- 1) Die Überwurfmutter (11) werden abgeschraubt und auf die beiden Rohrenden geschoben.
- 2) Die beiden Anschlußteile (7) werden je nach Art auf die Rohrleitung geklebt oder aufgeschraubt. (Hinweis: Technische Informationen).
- 3) Danach wird der Kugelhahn zwischen die beiden Anschlußteile gebracht.
- 4) Die Überwurfmutter ist anzuziehen.
- 5) Die Überwurfmutter an der Pfeilspitze "REGULIEREN" wird dann je nach Erfordernissen (Druck) angezogen zur Erreichung einer optimalen Abdichtung.
- 6) **Vorsicht: -Bei Hochdrucktests muß die Beschriftung "REGOLARE-ADJUST" auf dem Ventil unbedingt in Flußrichtung aufwärts zeigen.**
 - Auf keinen Fall beim Testen thermoplastischer Rohre Druckluft oder andere Gasarten verwenden.
 - Das abgeschlossene Ventil darf beim Testen nie höherem Druck als bei Normalbelastung ausgesetzt werden (siehe "Technische Daten", Zeichnung nr. 3).

• Für Sicherheitsfragen, wenden Sie sich bitte an den technischen Verkauf, wenn Sie flüchtige Medien wie Wasserstoffperoxid (H₂O₂) oder Natrium Hypochlorit (NaClO) verwenden: die Medien können verdampfen mit einer gefährlichen Druckerhöhung in dem Totenraum zwischen der Kugel und dem Gehäuse.

Schnelle Schließbetätigungen sind unbedingt zu vermeiden. Ebenso Einbau-Lagen und -Orte, bei denen eine zufällige (unbeabsichtigte) Betätigung erfolgen kann.



VE PVC-U**Smontaggio**

- 1) Isolare la valvola dalla linea.
- 2) Svitare completamente le ghiere (11) e sfilare lateralmente la cassa.
- 3) Dopo aver portato la valvola in posizione di chiusura, estrarre la maniglia (1) ed introdurre la chiave nella corrispondente apertura del supporto (8), estraendolo con una rotazione.
- 4) Premere sulla sfera, avendo cura di non rigarla, fino a che non se ne ottiene la fuoriuscita.
- 5) Premere sull'asta comando (3) verso l'interno fino ad estrarla dalla cassa.
- 6) Ovviamente tutti gli O-ring vanno estratti dalle loro sedi, come da esploso.

Disassembly

- 1) Isolate the valve from the line.
- 2) Unscrew both union nuts (11) and drop the valve body out of the line.
- 3) After closing the valve, remove the handle (1) and push the key into the corresponding recess on the support (8). Rotate the support.
- 4) Press the ball, taking care not to score it, until it drops out.
- 5) Press the stem (3) to drop through into the valve body.
- 6) All the O-rings must be removed from their grooves, as shown in the exploded view.

Démontage

- 1) Isolez le flux en amont du robinet.
- 2) Dévissez complètement les écrous (11) et enlevez latéralement le corps.
- 3) Après avoir mis le robinet en position de fermeture, enlevez la poignée (1) et introduisez la clef dans l'ouverture correspondante du support, en l'extrayant par une rotation.
- 4) Exercez une pression sur la sphère (en ayant soin de ne pas abîmer la surface d'étanchéité), jusqu'à ce que la sphère sorte.
- 5) Exercez une pression sur la tige de manoeuvre (3) vers l'intérieur pour la faire sortir.
- 6) Tous les O-rings doivent être enlevés de leurs logements.

Demontage

- 1) Die Leitung ist an geeigneter Stelle drucklos zu machen und zu entleeren.
- 2) Nach dem Lösen beider Überwurfmutter (11) kann der Kugelhahn aus der Leitung entfernt werden.
- 3) Nachdem die Kugel in die geschlossene Stellung gebracht wurde, ist der Handgriff abzuziehen, und mit seinen Nocken (Schlüssel) der Dichtungsträger drehend zu lösen.
- 4) Durch vorsichtiges Drücken auf die Kugel (5) wird diese herausgedrückt.
- 5) Die Demontage der Spindel (3) erfolgt durch Hineindrücken in das Gehäuse.
- 6) Alle O-Ringe werden, wie in der Explosionszeichnung dargestellt, aus ihren Nuten entfernt.

**Montaggio**

- 1) Inserire l'asta comando (3) dall'interno della cassa.
- 2) Inserire la guarnizione in PE (9) nella sede della cassa (4).
- 3) Inserire la sfera (5).
- 4) Avvitare nella cassa il supporto (8) servendosi della chiave posta sulla maniglia.
- 5) La maniglia (1) va posizionata sull'asta comando (3).
- 6) Inserire i manicotti (7) e le ghiere (11) avendo cura che gli O-ring di tenuta di testa (10) non fuoriescano dalle sedi.
- 7) Ovviamente tutti gli O-ring vanno inseriti nelle loro sedi, come da esploso.

Assembly

- 1) Insert the stem (3) from inside the valve body.
- 2) Place the PE seat (9) in its housing located in the valve body (4).
- 3) Insert the ball (5).
- 4) Screw the support (8) into the body using the key housed in the handle.
- 5) The handle (1) has to be pressed onto the stem (3).
- 6) Insert the end connectors (7) and the union nuts (11) taking care that the socket O-rings (10) do not come out of their grooves.
- 7) All the O-rings must be inserted in their grooves as shown in the exploded view.

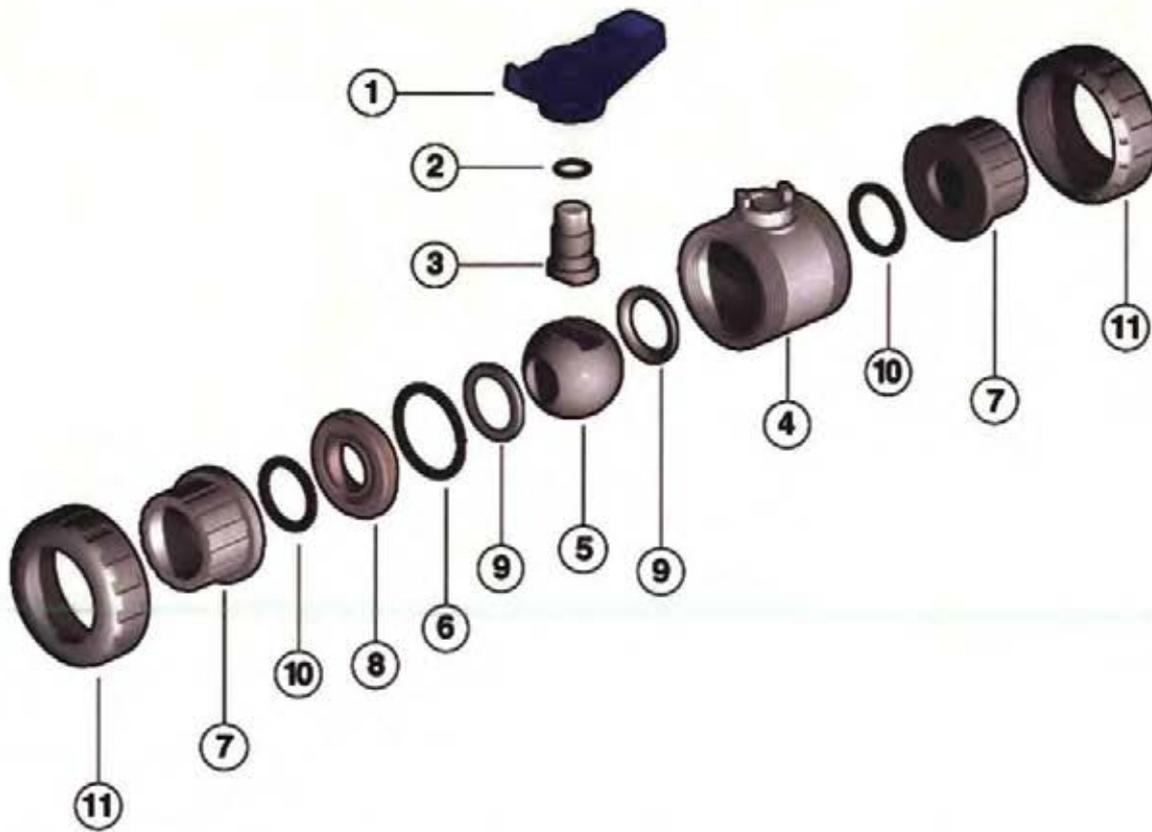
Montage

- 1) Insérez la tige de manoeuvre (3) dans le corps en passant par l'intérieur.
- 2) Insérez la garniture en PE (9) dans le siège du corps (4).
- 3) Insérez la sphère (5).
- 4) Visser dans le corps le support (8) en utilisant la clef insérée sur le volant.
- 5) La poignée (1) doit être positionnée sur la tige de manoeuvre (3).
- 6) Insérez les collets (7) et les écrous (11) en ayant soin que les joints des collets (10) ne sortent pas de leur logement.
- 7) Tous les O-rings doivent naturellement être insérés dans leur logement.

Montage

- 1) Die Spindel (3) ist von der Innenseite des Gehäuses her einzusetzen.
- 2) Die PE-Dichtung (9) ist in das Gehäuse (4) einzulegen.
- 3) Danach ist die Kugel (5) zu montieren.
- 4) Der Dichtungsträger ist in das Gehäuse einzuschrauben und mit dem Handgriffschlüssel anzuziehen.
- 5) Der Handgriff (1) wird auf die Spindel (3) aufgesteckt.
- 6) Die Anschlußteile (7) und die Überwurfmutter (11) sind zu montieren, wobei zu beachten ist, daß die O-Ringe (10) in ihren Nuten bleiben.
- 7) Natürlich sind alle in der Explosionszeichnung dargestellten O-Ringe bei der Montage in die entsprechenden Nuten einzulegen.

VE PVC-U



Pos.	Componenti	Materiale	Q.tà
1	maniglia	HIPVC	1
*2	guarnizione dell'asta comando	CR	1
3	asta comando	PVC-U	1
4	cassa	PVC-U	1
5	sfera	PVC-U	1
*6	guarnizione o-ring tenuta radiale	CR	1
*7	manicotto	PVC-U	2
*8	supporto della guarnizione della sfera	PVC-U	1
*9	guarnizione della sfera	PE	2
*10	guarnizione o-ring tenuta di testa	CR	2
11	ghiera	PVC-U	2

* parti di ricambio

Pos.	Composants	Materiaux	Q.té
1	volant	HIPVC	1
*2	joint de la tige de manoeuvre	CR	1
3	tige de manoeuvre	PVC-U	1
4	corps	PVC-U	1
5	sphère	PVC-U	1
*6	joint du corps	CR	1
*7	collet	PVC-U	2
*8	support de la garniture de la sphaere	PVC-U	1
*9	sphaere garniture de la sphaere	PE	2
*10	joint du collet	CR	2
11	écrou-union	PVC-U	2

* pièce de rechange

Pos.	Components	Material	Q.ty
1	handle	HIPVC	1
*2	stem o-ring	CR	1
3	stem	PVC-U	1
4	body	PVC-U	1
5	ball	PVC-U	1
*6	body o-ring	CR	1
*7	end connector	PVC-U	2
*8	support for ball seat	PVC-U	1
*9	ball seat	PE	2
*10	socket o-ring	CR	2
11	union nut	PVC-U	2

* spare parts

Pos.	Benennung	Werkstoff	Menge
1	Handgriff	HIPVC	1
*2	O-Ring	CR	1
3	Spindel	PVC-U	1
4	Gehäuse	PVC-U	1
5	Kugel	PVC-U	1
*6	O-Ring	CR	1
*7	Anschlußteil	PVC-U	2
*8	Dichtungsträger	PVC-U	1
*9	Kugeldichtung	PE	2
*10	O-Ring	CR	2
11	Überwurfmutter	PVC-U	2

* Ersatzteile

Cod

VEJV pag. 109

d	Cod.
1/2"	VEJV012
3/4"	VEJV034
1"	VEJV100
1 1/4"	VEJV114
1 1/2"	VEJV112
2"	VEJV200
2 1/2"	VEJV212
3"	VEJV300
4"	VEJV400

VEGV pag. 109

R	Cod.
1/2"	VEGV012
3/4"	VEGV034
1"	VEGV100
1 1/4"	VEGV114
1 1/2"	VEGV112
2"	VEGV200
2 1/2"	VEGV212
3"	VEGV300
4"	VEGV400

VELV pag. 108

d	Cod.
1/2"	VELV012
3/4"	VELV034
1"	VELV100
1 1/4"	VELV114
1 1/2"	VELV112
2"	VELV200
2 1/2"	VELV212
3"	VELV300
4"	VELV400

VEIV pag. 107

d	Cod.
16	VEIV016
20	VEIV020
25	VEIV025
32	VEIV032
40	VEIV040
50	VEIV050
63	VEIV063
75	VEIV075
90	VEIV090
110	VEIV110
125	VEIV125

VEAV pag. 108

d	Cod.
1/2"	VEAV012
3/4"	VEAV034
1"	VEAV100
1 1/4"	VEAV114
1 1/2"	VEAV112
2"	VEAV200
2 1/2"	VEAV212
3"	VEAV300
4"	VEAV400

VENV pag. 108

R	Cod.
3/8"	VENV038
1/2"	VENV012
3/4"	VENV034
1"	VENV100
1 1/4"	VENV114
1 1/2"	VENV112
2"	VENV200
2 1/2"	VENV212
3"	VENV300
4"	VENV400

VEFV pag. 107

R	Cod.
3/8"	VEFV038
1/2"	VEFV012
3/4"	VEFV034
1"	VEFV100
1 1/4"	VEFV114
1 1/2"	VEFV112
2"	VEFV200
2 1/2"	VEFV212
3"	VEFV300
4"	VEFV400



APPENDIX 16



Stübbe®

Pressure Reducing Valve

Type DMV 755, DMV 765



Advantages

- high reproducibility of setting pressure
- great operating security and long service life
- steady low vibration controlling
- safe mounting with stainless steel bolts
- hermetically sealed by diaphragm with crimped O-rings
- low maintenance
- pressure settings at any time, also during operation
- simple connection to the pipeline
- radial demountability even after mounting
- short compact dimensions in case of threaded necks
- direct mounting on any valve support by metal inserts in the body, the movability of the union nuts is not effected

Application

- chemical plants
- water treatment
- electroplating

Utilisation

- Directly controlled by the operating fluid the DMV 755/765 reduces the primary pressure to working pressure caused by system and keeps the operating pressure constant.

Type of fluids

Technically clean, neutral and aggressive fluids provided that the valve materials are resistant at the operating temperature. Refer to the ASV resistance guide.

Media temperature

- see pressure/temperature diagram

Pressure rating

- PN 10 at +20°C

Operating pressure

- PN 10

Set range

- DMV 755 DN 10 - DN 50 1,0 - 9,0 bar
- DMV 765 DN 10 - DN 50 0,5 - 9,0 bar

Working pressure (secondary pressure)

- set pressure minus flow depending pressure reduction:
 - DMV 755 1,0 - 9,0 bar
 - DMV 765 0,5 - 9,0 bar

Constant working pressure

- Difference between maximal and minimal secondary pressure due to primary pressure fluctuations: approx. $\pm 0,2$ bar

Hysteresis

- difference between opening and closing pressure: approx. 0,1 - 0,4 bar

Size

- DN 10 - DN 50

DIBT approval

- PVC-U Z-40.23-193
- PP Z-40.23-194
- PVDF Z-40.23-195

Valve body, piston and separation disc

- PVC-U (polyvinyl chloride)
- PP (polypropylene)
- PVDF (polyvinylidene fluoride)

Valve bonnet

- PP-GFR

Moulded diaphragm

- EPDM, PTFE-coated on fluid side

ASV Stübbe GmbH & Co. KG • Hollwieser Straße 5 • D-32602 Vlotho • Fon +49(0)5733 - 799-0 • Fax +49(0)5733 - 799-200 • www.asv-stuebbe.de • contact@asv-stuebbe.de

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Pressure Reducing Valve DMV 755, DMV 765

Valve seat seal

- EPDM
- FPM

O-ring sealings at union ends

- EPDM
- FPM

Connection screws

- stainless steel 1.4301

Connection

- body with threaded necks acc. to DIN 8063 completed with:
 - union nut made of PVC-U, PP or PVDF
 - insert with socket end made of PVC-U, PP or PVDF
 - O-ring in EPDM or FPM
- On request we deliver:
 - insert with spigot end for fusion welding made of PP or PE
 - dimensions acc. BS, ANSI and JIS on request
- body with spigot ends for solvent or fusion welding acc. to DIN ISO

We kindly ask for your inquiry.

Mounting

- variable

Flow direction

- direction of flow always in direction of arrow

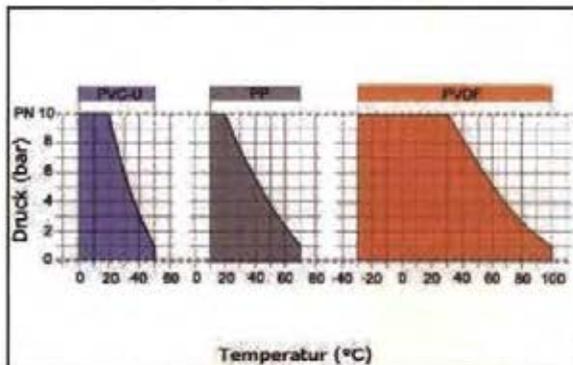
Colour

- body

PVC-U	grey, RAL 7011
PP	grey, RAL 7032
PVDF	opaque (yellowish white)
- bonnet

PP-GFK	orange, RAL 2004
--------	------------------

Pressure/temperature diagram



The pressure/temperature limits are applicable for a computed operating life factor of 25 years at PN 10. The values are a guide for harmless fluids (DIN 2403)

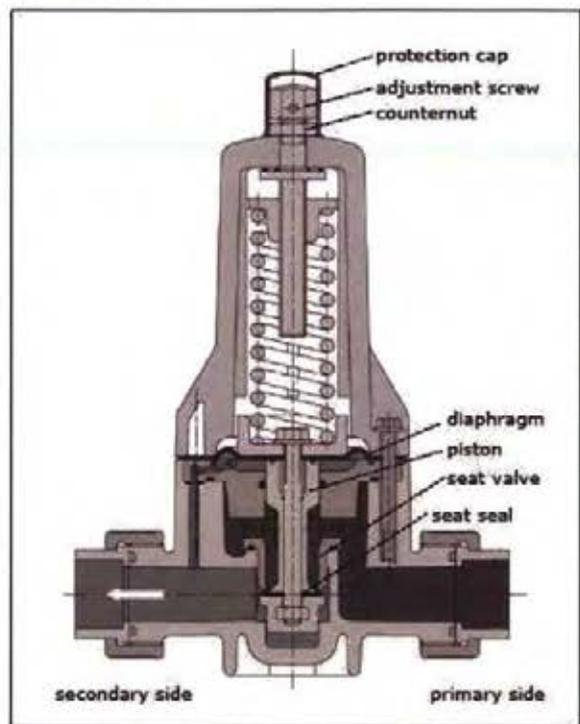
the material of the valve is resistant against.

For other media see the ASV resistance guide.

Durability of wear and tear parts is depending on the operating conditions of the application.

Values < 0 °C (PP < +10 °C) on request with exact data of operation.

Sectional drawing pressure reducing valve type DMV 765



Valve function and design

Under operation conditions the ASV valve DMV 755/765 is always open which means it is balanced between the inlet pressure (primary side) and the lower outlet/working pressure (secondary side). At any rise of working pressure at the valve outlet a pressure compensation via the control bore takes place at the area below the diaphragm. The higher working pressure activates the large diaphragm and lifts the piston against the spring force. The flow reduces and the working pressure drops down until balanced condition is reached again. When the working pressure drops the described procedure reverses. The spring force opens the valve against the lower pressure force below the diaphragm. The flow rises until the balanced condition is reached again.

NOTE

If the secondary pressure is additionally increased by the back pressure, the pressure reducing valve works as a non-return valve. This pressure can lead to the destruction of the valve piston.

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Stübbe®

Pressure Reducing Valve DMV 755, DMV 765

Valve setting and adjustment

The presetting or readjustment is made by removing the protection cap at setting control screw with a counternut and by reading the set pressure from the ASV diaphragm pressure gauge guard type 902 in the pipe system. The counternut can be leaded.

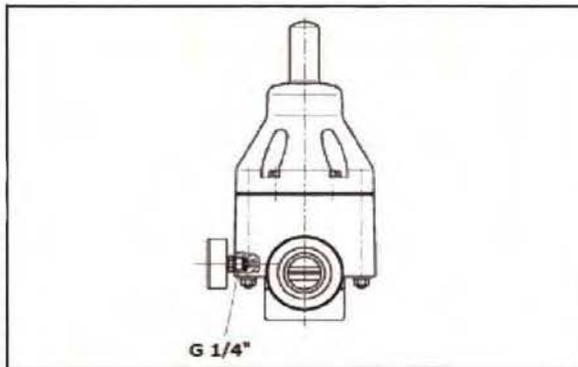
Pressure reducing valve with pressure gauge

On request the valve can be equipped by the manufacturer with a gauge (adhere to the resistance guide).

Flow diagram (see page 11)

There are two different applications the pressure reducing valves can be used for. The difference has to be seen in the way of valve setting at static or dynamic system pressure conditions.

DMV 755 with factory-made pressure gauge



Operating instructions

ATTENTION

Safe operation of the valve can only be ensured if it is properly installed, operated, serviced or repaired by qualified personnel according to its intended use while observing the accident prevention regulations, safety regulations, relevant standards and technical regulations or data sheets such as e.g DIN, DIN EN, DIN ISO and DVS* for example.

The intended use includes adhering to the specified limit values for pressure and temperature as well as checking the chemical resistance with regard to the operating conditions.

For this purpose, ensure that all components getting in contact with the media are **"resistant"** in accordance with the ASV resistance guide.

The owner/user must inform the authorized qualified personnel instructed to perform the assembly, inspection and/or maintenance work of any potential danger emanating from the machine line/medium, and ensure that suitable safety measures are observed. This also includes the consideration of local regulations and laws of the territories of use.

If the authorized qualified personnel does not have any operating and maintenance instruction this is to be requested prior installation, maintenance or repair.

Non-observance of the specified instructions and safety regulations may cause damage to health and/or damage to assets. ✓

*DVS = German Welding Society

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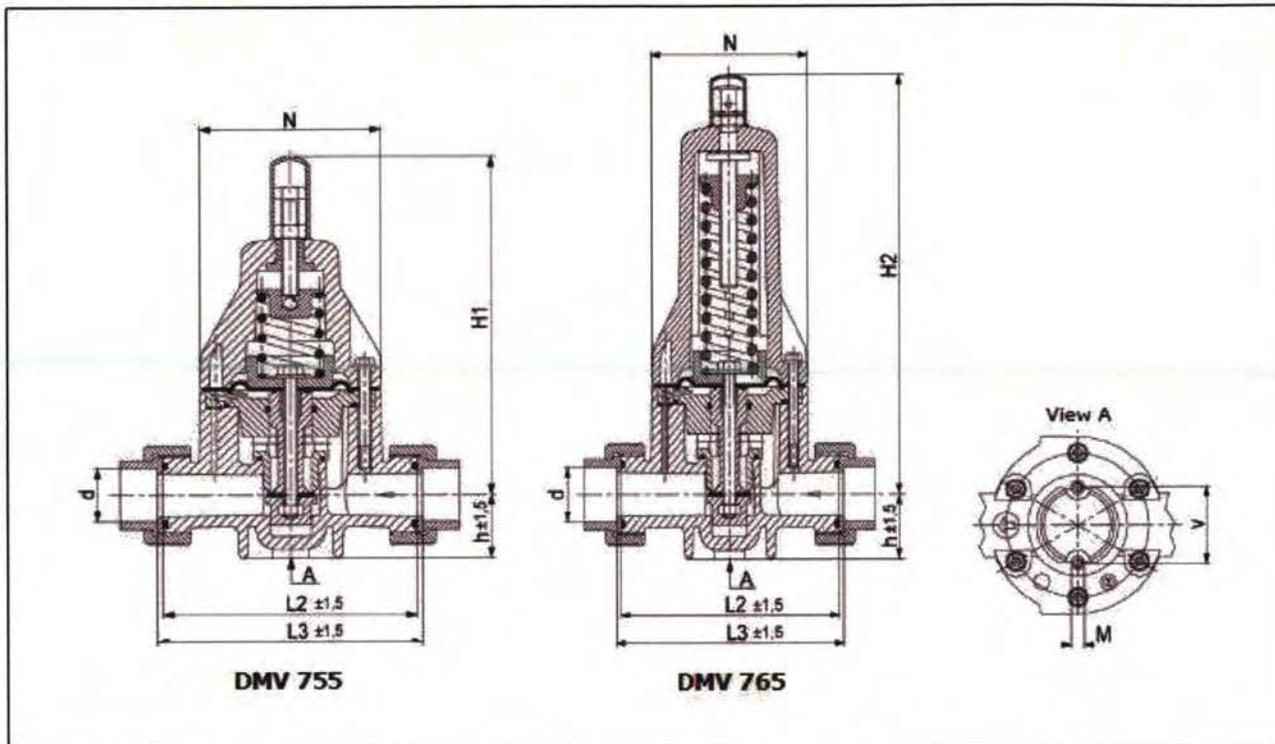
330154 - 2007/01/17

3



Pressure Reducing Valve DMV 755, DMV 765

Dimensions, DMV 755, DMV 765 with union socket ends for solvent or fusion welding



dimension	d (mm)	16	20	25	32	40	50	63
DN (mm)		10	15	20	25	32	40	50
DN (inch)		3/8	1/2	3/4	1	1 1/4	1 1/2	2
PP/PVC-U	h	25,0	25,0	37,0	37,0	57,0	57,0	57,0
PVDF	h	24,0	24,0	36,0	36,0	54,0	54,0	54,0
	H1	174,0	174,0	202,0	202,0	262,0	262,0	262,0
	H2	207,0	207,0	243,0	243,0	348,0	348,0	348,0
PP/PVC-U	L2	120,0	120,0	150,0	150,0	205,0	205,0	205,0
PVDF	L2	118,0	118,0	147,0	147,0	200,0	200,0	200,0
	L3	126,0	126,0	156,0	156,0	211,0	211,0	211,0
	L3	124,0	124,0	153,0	153,0	207,0	207,0	207,0
	M	M6	M6	M6	M6	M8	M8	M8
	N	81,0	81,0	107,0	107,0	147,0	147,0	147,0
	v	40,0	40,0	46,0	46,0	65,0	65,0	65,0
weight	kg (standard value)							
DFM 755								
PP		0,7	0,7	1,6	1,6	4,1	4,2	4,3
PVC		0,8	0,9	1,9	1,9	5,0	5,1	5,2
PVDF		1,0	1,1	2,1	2,2	5,5	5,6	5,7
DFM 765								
PP		0,8	0,8	1,9	2,0	5,2	5,4	5,6
PVC		1,0	1,0	2,2	2,3	6,0	6,2	6,4
PVDF		1,2	1,2	2,5	2,5	6,5	6,7	6,9

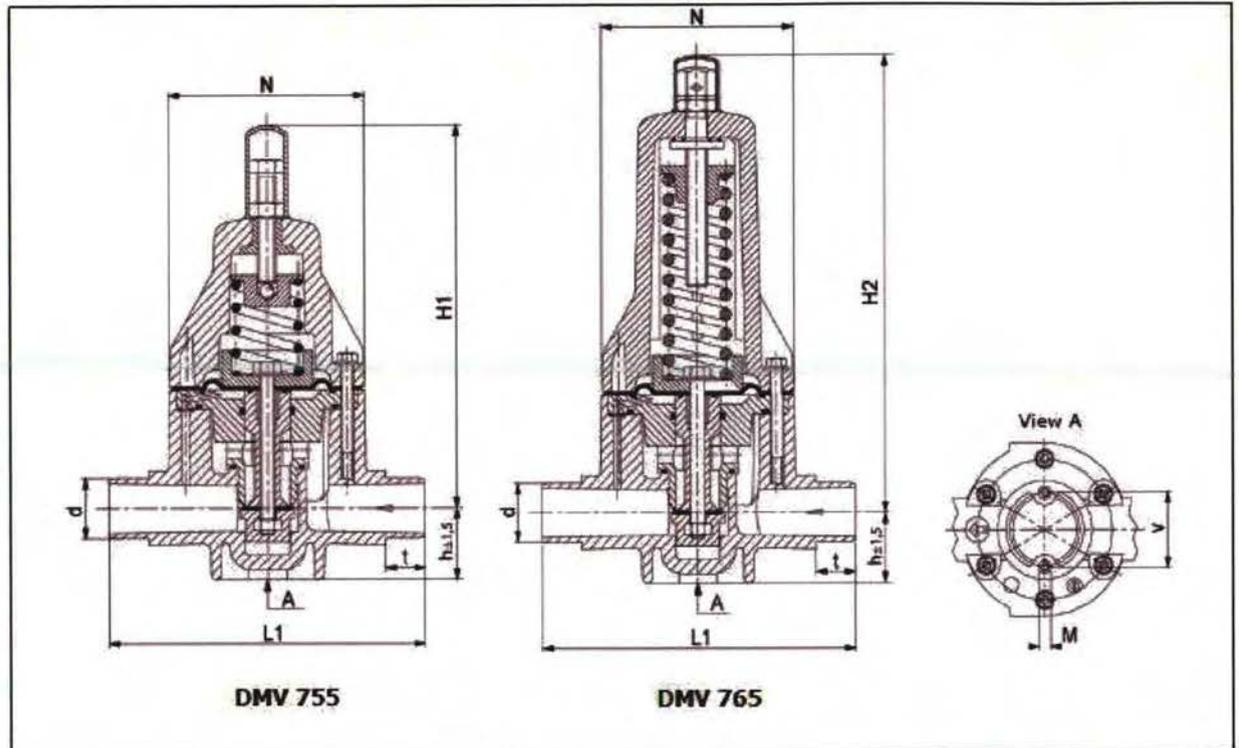
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Stübbe®

Pressure Reducing Valve DMV 755, DMV 765

Dimensions, DMV 755 und DMV 765 with spigot ends for solvent or fusion welding



dimension	d (mm)	16	20	25	32	40	50	63
DN (mm)	10	15	20	25	32	40	50	63
DN (inch)	3/8	1/2	3/4	1	1 1/4	1 1/2	2	
PP/PVC-U	h	25,0	25,0	37,0	37,0	57,0	57,0	57,0
PVDF	h	24,0	24,0	36,0	36,0	54,0	54,0	54,0
	H1	174,0	174,0	202,0	202,0	262,0	262,0	262,0
	H2	207,0	207,0	243,0	243,0	348,0	348,0	348,0
PP	L1	144 ^{+2,1}	144 ^{+2,1}	174 ^{+2,6}	174 ^{+2,6}	224 ^{+3,3}	224 ^{+3,3}	244 ^{+3,6}
PVC-U	L1	144 ^{+1,0}	144 ^{+1,0}	174 ^{+1,0}	174 ^{+1,0}	224 ^{+1,1}	224 ^{+1,1}	244 ^{+1,2}
PVDF	L1	144 ^{+2,1}	144 ^{+2,1}	174 ^{+2,6}	174 ^{+2,6}	224 ^{+3,3}	224 ^{+3,3}	244 ^{+3,6}
	M	M6	M6	M6	M6	M8	M8	M8
	N	81,0	81,0	107,0	107,0	147,0	147,0	147,0
	v	40,0	40,0	46,0	46,0	65,0	65,0	65,0
weight	kg (standard value)							
DFM 755								
PP		0,7	0,7	1,6	1,6	4,1	4,2	4,3
PVC		0,8	0,9	1,9	1,9	5,0	5,1	5,2
PVDF		1,0	1,1	2,1	2,2	5,5	5,6	5,7
DFM 765								
PP		0,8	0,8	1,9	2,0	5,2	5,4	5,6
PVC		1,0	1,0	2,2	2,3	6,0	6,2	6,4
PVDF		1,2	1,2	2,5	2,5	6,5	6,7	6,9

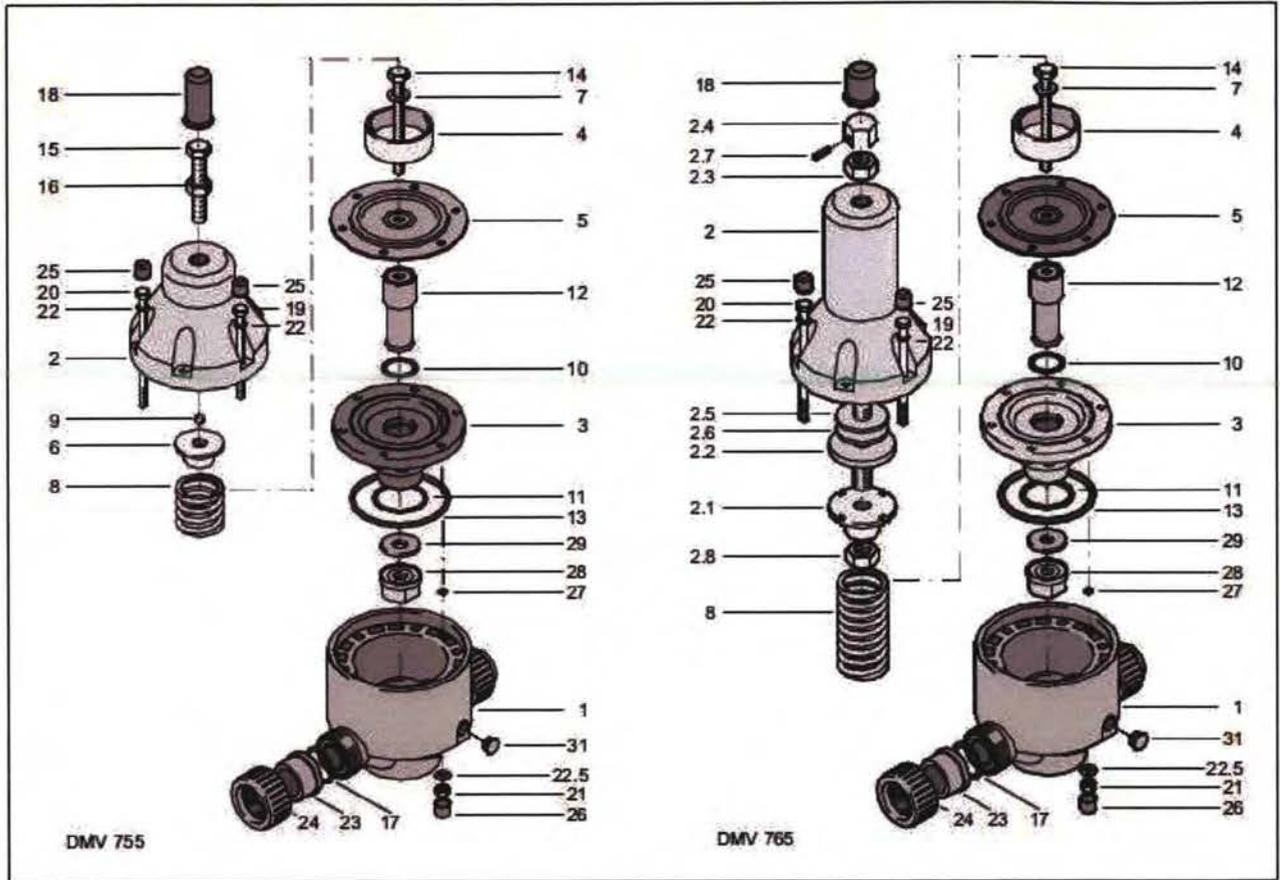
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Pressure Reducing Valve DMV 755, DMV 765

Spare part and parts list



item	description	quantity
1	valve body	1
2	bonnet	1
2.1	spring nut	1
2.2	adjustment screw	1
2.3	section nut	1
2.4	cap nut	1
2.5	axial bearing disc	1
2.6	axial needle roller	1
2.7	clamping sleeve	1
2.8	hexagonal nut	1
3	separation disc*	1
4	spring plate	1
5	sealing diaphragm*	1
6	pressure plate	1
7	disc	1
8	pressure spring	1
9	steel ball	1
10	O-ring*	1
11	O-ring*	1
12	piston*	1
13	O-ring*	1

item	description	quantity
14	hexagonal screw	1
15	hexagonal screw	1
16	counternut	1
17	O-ring*	2
18	protection cap	1
19	hexagonal screw	2
20	hexagonal screw	4
21	hexagonal nut	4/6
22	disc	4/6
22.5	disc	4/6
23	insert	2
24	union nut	2
25	protection cap	4/6
26	protection cap	4/6
27	O-ring*	1
28	piston guide*	1
29	gasket*	1
31	protection plug	2

All parts marked with * are included in the respective wear and tear part set. When ordering spare parts please state the complete valve ident number and serial number. Quantities depend on size.

APPENDIX 17



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1 How to Read these Operating Instructions

1

VLT AQUA Drive FC 200 Series Software version: 1.33



This guide can be used with all FC 200 frequency converters with software version 1.33 or later.
The actual software version number can be read from par. 15-43 *Software Version*.



1.1.1 Copyright, limitation of liability and revision rights

1

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Danfoss reserves the right to revise this publication at any time and to make changes to its contents without prior notice or any obligation to notify former or present users of such revisions or changes.

1.1.2 Available literature for VLT® AQUA Drive FC 200

- VLT® AQUA Drive Operating Instructions MG.20.Mx.yy provide the necessary information for getting the drive up and running.
- VLT® AQUA Drive High Power Operating Instructions MG.20.Px.yy provide the necessary information for getting the HP drive up and running.
- VLT® AQUA Drive Design Guide MG.20.Nx.yy entails all technical information about the drive and customer design and applications.
- VLT® AQUA Drive Programming Guide MN.20.Ox.yy provides information on how to programme and includes complete parameter descriptions.
- VLT® AQUA Drive FC 200 Profibus MG.33.Cx.yy
- VLT® AQUA Drive FC 200 DeviceNet MG.33.Dx.yy
- Output Filters Design Guide MG.90.Nx.yy
- VLT® AQUA Drive FC 200 Cascade Controller MI.38.Cx.yy
- Application Note MN20A102: Submersible Pump Application
- Application Note MN20B102: Master/Follower Operation Application
- Application Note MN20F102: Drive Closed Loop and Sleep Mode
- Instruction MI.38.Bx.yy: Installation Instruction for Mounting Brackets Enclosure type A5, B1, B2, C1 and C2 IP21, IP55 or IP66
- Instruction MI.90.Lx.yy: Analog I/O Option MCB109
- Instruction MI.33.Hx.yy: Panel through mount kit

x = Revision number

yy = Language code

Danfoss technical literature is also available online at

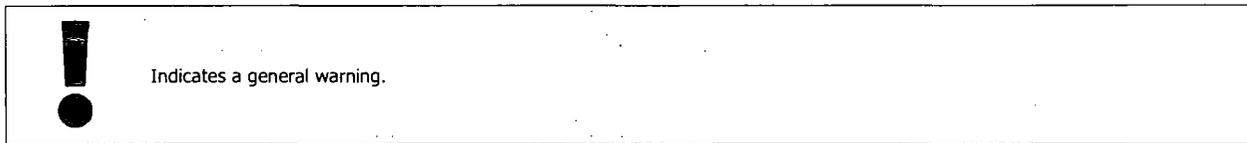
www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation.htm.

1.1.3 Approvals



1.1.4 Symbols

Symbols used in these Operating Instructions.



2 Safety

2.1.1 Safety note



The voltage of the frequency converter is dangerous whenever connected to mains. Incorrect installation of the motor, frequency converter or fieldbus may cause damage to the equipment, serious personal injury or death. Consequently, the instructions in this manual, as well as national and local rules and safety regulations, must be complied with.

2

Safety Regulations

1. The frequency converter must be disconnected from mains if repair work is to be carried out. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
2. The [STOP/RESET] key on the control panel of the frequency converter does not disconnect the equipment from mains and is thus not to be used as a safety switch.
3. Correct protective earthing of the equipment must be established, the user must be protected against supply voltage, and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The earth leakage currents are higher than 3.5 mA.
5. Protection against motor overload is set by par. 1-90 *Motor Thermal Protection*. If this function is desired, set par. 1-90 to data value [ETR trip] (default value) or data value [ETR warning]. Note: The function is initialised at 1.16 x rated motor current and rated motor frequency. For the North American market: The ETR functions provide class 20 motor overload protection in accordance with NEC.
6. Do not remove the plugs for the motor and mains supply while the frequency converter is connected to mains. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
7. Please note that the frequency converter has voltage inputs other than L1, L2 and L3, when load sharing (linking of DC intermediate circuit) and external 24 V DC have been installed. Check that all voltage inputs have been disconnected and that the necessary time has passed before commencing repair work.

Installation at High Altitudes



Installation at high altitude:

- 380 - 480 V: At altitudes above 3 km, please contact Danfoss Drives regarding PELV.
525 - 690 V: At altitudes above 2 km, please contact Danfoss Drives regarding PELV.

Warning against Unintended Start

1. The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the frequency converter is connected to mains. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient.
2. While parameters are being changed, the motor may start. Consequently, the stop key [RESET] must always be activated; following which data can be modified.
3. A motor that has been stopped may start if faults occur in the electronics of the frequency converter, or if a temporary overload or a fault in the supply mains or the motor connection ceases.



Warning:

Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.

Also make sure that other voltage inputs have been disconnected, such as external 24 V DC, load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back up.

2.1.2 General warning



Leakage Current

The earth leakage current from the VLT AQUA Drive FC 200 exceeds 3.5 mA. According to IEC 61800-5-1 a reinforced Protective Earth connection must be ensured by means of: a min. 10mm² Cu or 16mm² Al PE-wire or an additional PE wire - with the same cable cross section as the Mains wiring - must be terminated separately.

Residual Current Device

This product can cause a D.C. current in the protective conductor. Where a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) shall be used on the supply side of this product. See also RCD Application Note MN.90.GX.02. Protective earthing of the VLT AQUA Drive FC 200 and the use of RCD's must always follow national and local regulations.

2.1.3 Before commencing repair work

1. Disconnect the frequency converter from mains
2. Disconnect DC bus terminals 88 and 89
3. Wait at least the time mentioned in section General Warning above
4. Remove motor cable

2.1.4 Special conditions

Electrical ratings:

The rating indicated on the nameplate of the frequency converter is based on a typical 3-phase mains power supply, within the specified voltage, current and temperature range, which is expected to be used in most applications.

The frequency converters also support other special applications, which affect the electrical ratings of the frequency converter. Special conditions which affect the electrical ratings might be:

- Single phase applications
- High temperature applications which require derating of the electrical ratings
- Marine applications with more severe environmental conditions.

Consult the relevant clauses in these instructions and in the **VLT® AQUA Drive Design Guide** for information about the electrical ratings.

Installation requirements:

The overall electrical safety of the frequency converter requires special installation considerations regarding:

- Fuses and circuit breakers for over-current and short-circuit protection
- Selection of power cables (mains, motor, brake, loadsharing and relay)
- Grid configuration (IT, TN, grounded leg, etc.)
- Safety of low-voltage ports (PELV conditions).

Consult the relevant clauses in these instructions and in the **VLT® AQUA Drive Design Guide** for information about the installation requirements.

2.1.5 Caution



The frequency converter DC link capacitors remain charged after power has been disconnected. To avoid an electrical shock hazard, disconnect the frequency converter from the mains before carrying out maintenance. Wait at least as follows before doing service on the frequency converter:

Voltage (V)	Min. Waiting Time (Minutes)				
	4	15	20	30	40
200 - 240	0.25 - 3.7 kW	5.5 - 45 kW			
380 - 480	0.37 - 7.5 kW	11 - 90 kW	110 - 250 kW		315 - 1000 kW
525-600	0.75 kW - 7.5 kW	11 - 90 kW			
525-690		11 - 90 kW	45 - 400 kW	450 - 1200 kW	

Be aware that there may be high voltage on the DC link even when the LEDs are turned off.

2.1.6 Avoid un-intended start

NB!
 While the frequency converter is connected to mains, the motor can be started/stopped using digital commands, bus commands, references or via the Local Control Panel.

- Disconnect the frequency converter from mains whenever personal safety considerations make it necessary to avoid unintended start.
- To avoid unintended start, always activate the [OFF] key before changing parameters.
- Unless terminal 37 is turned off, an electronic fault, temporary overload, a fault in the mains supply, or lost motor connection may cause a stopped motor to start.

2.1.7 IT mains



IT mains
 Do not connect frequency converters with RFI-filters to mains supplies with a voltage between phase and earth of more than 440 V for 400 V converters and 760 V for 690 V converters.
 For 400 V IT mains and delta earth (grounded leg), mains voltage may exceed 440 V between phase and earth.
 For 690 V IT mains and delta earth (grounded leg), mains voltage may exceed 760 V between phase and earth.

par. 14-50 *RFI Filter* can be used to disconnect the internal RFI capacitors from the RFI filter to ground.

2.1.8 Disposal instruction



Equipment containing electrical components must not be disposed of together with domestic waste. It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

2.1.9 Safe Stop of the frequency converter (optional)

For versions fitted with a Safe Stop terminal 37 input, the frequency converter can perform the safety function *Safe Torque Off* (As defined by draft CD IEC 61800-5-2) or *Stop Category 0* (as defined in EN 60204-1).

It is designed and approved suitable for the requirements of Safety Category 3 in EN 954-1. This functionality is called Safe Stop. Prior to integration and use of Safe Stop in an installation, a thorough risk analysis on the installation must be carried out in order to determine whether the Safe Stop functionality and safety category are appropriate and sufficient. In order to install and use the Safe Stop function in accordance with the requirements of Safety Category 3 in EN 954-1, the related information and instructions of the VLT AQUA Drive Design Guide:MG.20.NX.YY must be followed! The information and instructions of the Operating Instructions are not sufficient for a correct and safe use of the Safe Stop functionality!



Prüf- und Zertifizierungsstelle
im BG-PRÜFZERT



BGIA
Berufsgenossenschaftliches
Institut für Arbeitsschutz
Hauptverband der gewerblichen
Berufsgenossenschaften

Translation
In any case, the German
original shall prevail.

Type Test Certificate

05 06004

No. of certificate

Name and address of the holder of the certificate: (customer) Danfoss Drives A/S, Ulnaes 1 DK-6300 Graasten, Dänemark

Name and address of the manufacturer: Danfoss Drives A/S, Ulnaes 1 DK-6300 Graasten, Dänemark

Ref. of customer:	Ref. of Test and Certification Body: Apf/Köh VE-Nr. 2003 23220	Date of Issue: 13.04.2005
-------------------	---	------------------------------

Product designation: Frequency converter with integrated safety functions

Type: VLT® Automation Drive FC 302

Intended purpose: Implementation of safety function „Safe Stop“

Testing based on: EN 954-1, 1997-03,
DKE AK 226.03, 1998-06,
EN ISO 13849-2; 2003-12,
EN 61800-3, 2001-02,
EN 61800-5-1, 2003-09,

Test certificate: No.: 2003 23220 from 13.04.2005

Remarks: The presented types of the frequency converter FC 302 meet the requirements laid down in the test bases.
With correct wiring a category 3 according to DIN EN 954-1 is reached for the safety function.

The type tested complies with the provisions laid down in the directive 98/37/EC (Machinery).

Further conditions are laid down in the Rules of Procedure for Testing and Certification of April 2004.

Head of certification body

.....
(Prof. Dr. rer. nat. Dietmar Reinert)

Certification officer

.....
(Dipl.-Ing. R. Apfeld)

130BA373.11

PZ810E
01.05



Postal address:
53754 Sand Augustin

Office:
Alte Meerstraße 111
53757 Sand Augustin

Phone: 0 22 41/2 31-02
Fax: 0 22 41/2 31-22 34

3 Introduction

3.1.2 Frequency converter identification

Below is an example of an identification label. This label is situated on the frequency converter and shows the type and options fitted to the unit. See table 2.1 for details of how to read the Type code string (T/C).

3



Illustration 3.1: This example shows an identification label for VLT AQUA Drive.

Please have T/C (type code) number and serial number ready before contacting Danfoss.

3.1.3 Abbreviations and standards

Abbreviations:	Terms:	SI-units:	I-P units:
a	Acceleration	m/s ²	ft/s ²
AWG	American wire gauge		
Auto Tune	Automatic Motor Tuning		
°C	Celsius		
I	Current	A	Amp
I _{LM}	Current limit		
Joule	Energy	J = N·m	ft-lb, Btu
°F	Fahrenheit		
FC	Frequency Converter		
f	Frequency	Hz	Hz
kHz	Kilohertz	kHz	kHz
LCP	Local Control Panel		
mA	Milliampere		
ms	Millisecond		
min	Minute		
MCT	Motion Control Tool		
M-TYPE	Motor Type Dependent		
Nm	Newton Metres		in-lbs
I _{M,N}	Nominal motor current		
f _{M,N}	Nominal motor frequency		
P _{M,N}	Nominal motor power		
U _{M,N}	Nominal motor voltage		
par.	Parameter		
PELV	Protective Extra Low Voltage		
Watt	Power	W	Btu/hr, hp
Pascal	Pressure	Pa = N/m ²	psi, psf, ft of water
I _{INV}	Rated Inverter Output Current		
RPM	Revolutions Per Minute		
SR	Size Related		
T	Temperature	C	F
t	Time	s	s,hr
T _{LM}	Torque limit		
U	Voltage	V	V

Table 3.2: Abbreviation and standards table .

4 Mechanical installation

4.1 Before starting

4.1.1 Checklist

When unpacking the frequency converter, ensure that the unit is undamaged and complete. Use the following table to identify the packaging:

Enclosure type:	A2 (IP 20/ 21)	A3 (IP 20/21)	A5 (IP 55/ 66)	B1/B3 (IP20/ 21/ 55/ 66)	B2/B4 (IP20/ 21/ 55/66)	C1/C3 (IP20/21/ 55/66)	C2/C4 (IP20/21/ 55/66)
Unit size (kW):							
200-240 V	0.25-3.0	3.7	0.25-3.7	5.5-11/ 5.5-11	15/ 15-18.5	18.5-30/ 22-30	37-45/ 37-45
380-480 V	0.37-4.0	5.5-7.5	0.37-7.5	11-18.5/ 11-18.5	22-30/ 22-37	37-55/ 45-55	75 - 90/ 75-90
525-600 V		0.75-7.5	0.75-7.5	11-18.5/ 11-18.5	22-37/ 22-37	45-55/ 45-55	75 - 90/ 75-90
525-690 V				-/	11-30/	-/	37-90/

Table 4.1: Unpacking table

Please note that a selection of screwdrivers (philips or cross-thread screwdriver and torx), a side-cutter, drill and knife is also recommended to have handy for unpacking and mounting the frequency converter. The packaging for these enclosures contains, as shown: Accessories bag(s), documentation and the unit. Depending on options fitted there may be one or two bags and one or more booklets.

4.2.1 Mechanical front views

A2	A3	A5	B1	B2	B3	B4	C1	C2	C3	C4
IP20/21*	IP20/21*	IP55/66	IP21/55/66	IP21/55/66	IP20/21*	IP20/21*	IP21/55/66	IP21/55/66	IP20/21*	IP20/21*
<p>Illustration 4.1: Top and bottom mounting holes.</p>						<p>Illustration 4.2: Top and bottom mounting holes. (B4+C3+C4 only)</p>				
<p>Accessory bags containing necessary brackets, screws and connectors are included with the drives upon delivery.</p>										
<p>All measurements in mm.</p>										
<p>* IP21 can be established with a kit as described in the section: IP 21/ IP 4X/ TYPE 1 Enclosure Kit in the Design Guide.</p>										

4.2.2 Mechanical dimensions

Mechanical dimensions														
Frame size (kW):		A2		A3		A5	B1	B2	B3	B4	C1	C2	C3	C4
200-240 V	T2	0.25-3.0		3.7		0.25-3.7	5.5-11	15	5.5-11	15-18.5	18.5-30	37-45	22-30	37-45
380-480 V	T4	0.37-4.0		5.5-7.5		0.37-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
525-600 V	T6			0.75-7.5		0.75-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
525-690 V	T7							11-30			37-90			
IP		20	21	20	21	55/66	21/ 55/66	21/55/66	20	20	21/55/66	21/55/66	20	20
NEMA		Chassis	Type 1	Chassis	Type 1	Type 12	Type 1/12	Type 1/12	Chassis	Chassis	Type 1/12	Type 1/12	Chassis	Chassis
Height (mm)														
Enclosure	A**	246	372	246	372	420	480	650	350	460	680	770	490	600
..with de-coupling plate	A2	374	-	374	-	-	-	-	419	595	-	-	630	800
Back plate	A1	268	375	268	375	420	480	650	399	520	680	770	550	660
Distance between mount. holes	a	257	350	257	350	402	454	624	380	495	648	739	521	631
Width (mm)														
Enclosure	B	90	90	130	130	242	242	242	165	231	308	370	308	370
With one C option	B	130	130	170	170	242	242	242	205	231	308	370	308	370
Back plate	B	90	90	130	130	242	242	242	165	231	308	370	308	370
Distance between mount. holes	b	70	70	110	110	215	210	210	140	200	272	334	270	330
Depth (mm)														
Without option A/B	C	205	205	205	205	200	260	260	248	242	310	335	333	333
With option A/B	C*	220	220	220	220	200	260	260	262	242	310	335	333	333
Screw holes (mm)														
	c	8.0	8.0	8.0	8.0	8.2	12	12	8	-	12	12	-	-
Diameter ø	d	11	11	11	11	12	19	19	12	-	19	19	-	-
Diameter ø	e	5.5	5.5	5.5	5.5	6.5	9	9	6.8	8.5	9.0	9.0	8.5	8.5
	f	9	9	9	9	9	9	9	7.9	15	9.8	9.8	17	17
Max weight (kg)		4.9	5.3	6.6	7.0	14	23	27	12	23.5	45	65	35	50
* Depth of enclosure will vary with different options installed.														
** The free space requirements are above and below the bare enclosure height measurement A. See section 3.2.3 for further information.														

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VLT® AQUA Drive
Operating Instructions



4 Mechanical installation

4 Mechanical installation

4.2.3 Mechanical mounting

All IP20 enclosure sizes as well as IP21/ IP55 enclosure sizes except A2 and A3 allow side-by-side installation.

If the IP 21 Enclosure kit (130B1122 or 130B1123) is used on enclosure A2 or A3; there must be a clearance between the drives of min. 50 mm.

For optimal cooling conditions allow a free air passage above and below the frequency converter. See table below.

4

Air passage for different enclosures													
Enclosure:	A2	A3	A5	B1	B2	B3	B4	C1	C2	C3	C4		
a (mm):	100	100	100	200	200	200	200	200	225	200	225		
b (mm):	100	100	100	200	200	200	200	200	225	200	225		

1. Drill holes in accordance with the measurements given.
2. You must provide screws suitable for the surface on which you want to mount the frequency converter. Re-tighten all four screws.

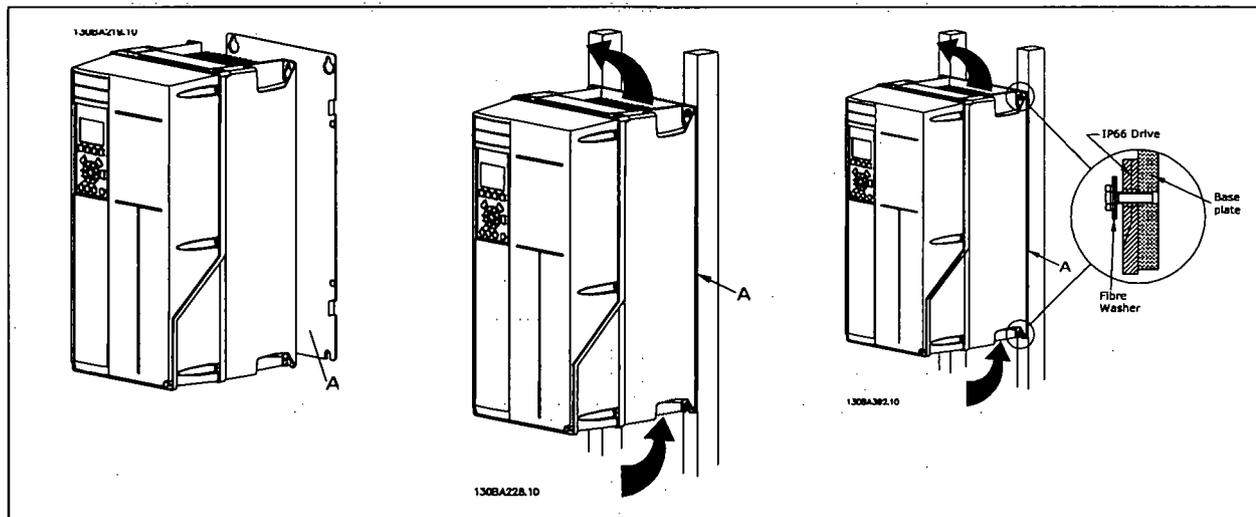


Table 4.2: Mounting frame sizes A5, B1, B2, B3, B4, C1, C2, C3 and C4 on a non-solid back wall, the drive must be provided with a back plate A due to insufficient cooling air over the heat sink.

With heavier drives (B4, C3, C4) use a lift. First wall-mount the 2 lower bolts - then lift the drive onto the lower bolts - finally fasten the drive against the wall with the 2 top bolts.

4.2.4 Safety requirements of mechanical installation



Pay attention to the requirements that apply to integration and field mounting kit. Observe the information in the list to avoid serious damage or injury, especially when installing large units.

The frequency converter is cooled by means of air circulation.

To protect the unit from overheating, it must be ensured that the ambient temperature *does not exceed the maximum temperature stated for the frequency converter* and that the 24-hour average temperature *is not exceeded*. Locate the maximum temperature and 24-hour average in the paragraph *Derating for Ambient Temperature*.

If the ambient temperature is in the range of 45 °C - 55 °C, derating of the frequency converter will become relevant, see *Derating for Ambient Temperature*.

The service life of the frequency converter is reduced if derating for ambient temperature is not taken into account.

4.2.5 Field Mounting

For field mounting the IP 21/IP 4X top/TYPE 1 kits or IP 54/55 units are recommended.

4.2.6 Panel through mounting

A Panel Through Mount Kit is available for frequency converter series , VLT Aqua Drive and.

In order to increase heatsink cooling and reduce panel depth, the frequency converter may be mounted in a through panel. Furthermore the in-built fan can then be removed.

The kit is available for enclosures A5 through C2.



NB!

This kit cannot be used with cast front covers. No cover or IP21 plastic cover must be used instead.

Information on ordering numbers is found in the *Design Guide*, section *Ordering Numbers*.

More detailed information is available in the *Panel Through Mount Kit instruction*, MI.33.H1.YY, where yy=language code.



5 Electrical Installation

5.1 How to Connect

5.1.1 Cables general



NB!
 Always comply with national and local regulations on cable cross-sections.

Details of terminal tightening torques.

Enclosure	Power (kW)			Torque (Nm)					
	200-240 V	380-480 V	525-600 V	Mains	Motor	DC connection	Brake	Earth	Relay
A2	0.25 - 3.0	0.37 - 4.0		1.8	1.8	1.8	1.8	3	0.6
A3	3.7	5.5 - 7.5	0.75 - 7.5	1.8	1.8	1.8	1.8	3	0.6
A5	0.25 - 3.7	0.37 - 7.5	0.75 - 7.5	1.8	1.8	1.8	1.8	3	0.6
B1	5.5 - 11	11 - 18.5		1.8	1.8	1.5	1.5	3	0.6
B2	15	22 30		4.5 4.5 ²⁾	4.5 4.5 ²⁾	3.7	3.7	3	0.6
B3	5.5 - 11	11 - 18.5	11 - 18.5	1.8	1.8	1.8	1.8	3	0.6
B4	15 - 18.5	22 - 37	22 - 37	4.5	4.5	4.5	4.5	3	0.6
C1	18.5 - 30	37 - 55		10	10	10	10	3	0.6
C2	37 45	75 90		14 24	14 24	14	14	3	0.6
C3	22 - 30	45 - 55	45 - 55	10	10	10	10	3	0.6
C4	37 - 45	75 - 90	75 - 90	14 24 ¹⁾	14 24 ¹⁾	14	14	3	0.6

Table 5.1: Tightening of terminals

1. For different cable dimensions x/y where $x \leq 95 \text{ mm}^2$ and $y \geq 95 \text{ mm}^2$.
2. Cable dimensions above 18.5 kW $\geq 35 \text{ mm}^2$ and below 22 kW $\leq 10 \text{ mm}^2$



5 Electrical Installation

5.1.2 Earthing and IT mains



The earth connection cable cross section must be at least 10 mm² or 2 rated mains wires terminated separately according to *EN 50178* or *IEC 61800-5-1* unless national regulations specify differently. Always comply with national and local regulations on cable cross-sections.

The mains is connected to the main disconnect switch if this is included.



NB!

Check that mains voltage corresponds to the mains voltage of the frequency converter name plate.

5

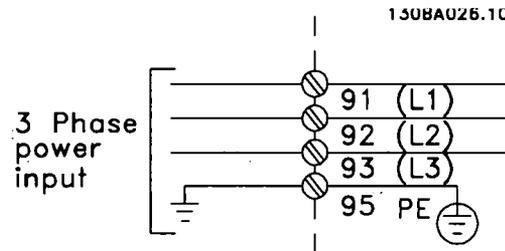


Illustration 5.1: Terminals for mains and earthing.



IT Mains

Do not connect 400 V frequency converters with RFI-filters to mains supplies with a voltage between phase and earth of more than 440 V.

For IT mains and delta earth (grounded leg), mains voltage may exceed 440 V between phase and earth.

5.1.3 Mains wiring overview

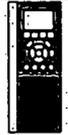
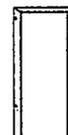
Enclosure:	A2 (IP 20/IP 21)	A3 (IP 20/IP 21)	A5 (IP 55/IP 66)	B1 (IP 21/IP 55/IP 66)	B2 (IP 21/IP 55/IP 66)	B3 (IP 20)	B4 (IP 20)	C1 (IP 21/IP 55/66)	C2 (IP 21/IP 55/66)	C3 (IP 20)	C4 (IP20)
											
Motor size (kW):											
200-240 V	0.25-3.0	3.7	1.1-3.7	5.5-11	15	5.5-11	15-18.5	18.5-30	37-45	22-30	37-45
380-480 V	0.37-4.0	5.5-7.5	1.1-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
525-600 V		1.1-7.5	1.1-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
525-690 V					11-30				37-90		
Goto:	5.1.6		5.1.7		5.1.8		5.1.9		5.1.10		

Table 5.2: Mains wiring table.

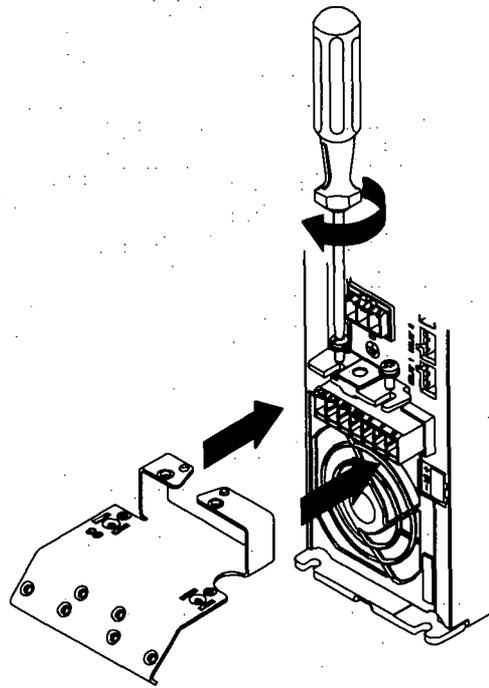
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5 Electrical Installation

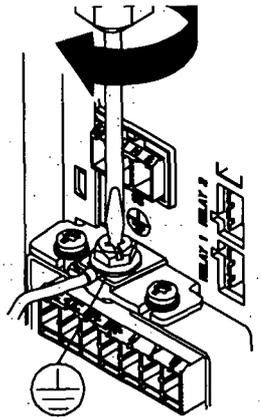
5.1.4 Mains connection for A2 and A3

5



130BA261.10

Illustration 5.2: First mount the two screws on the mounting plate, slide it into place and tighten fully.



130BA262.1C

Illustration 5.3: When mounting cables, first mount and tighten earth cable.



The earth connection cable cross section must be at least 10 mm² or 2 rated mains wires terminated separately according to EN 50178/IEC 61800-5-1.

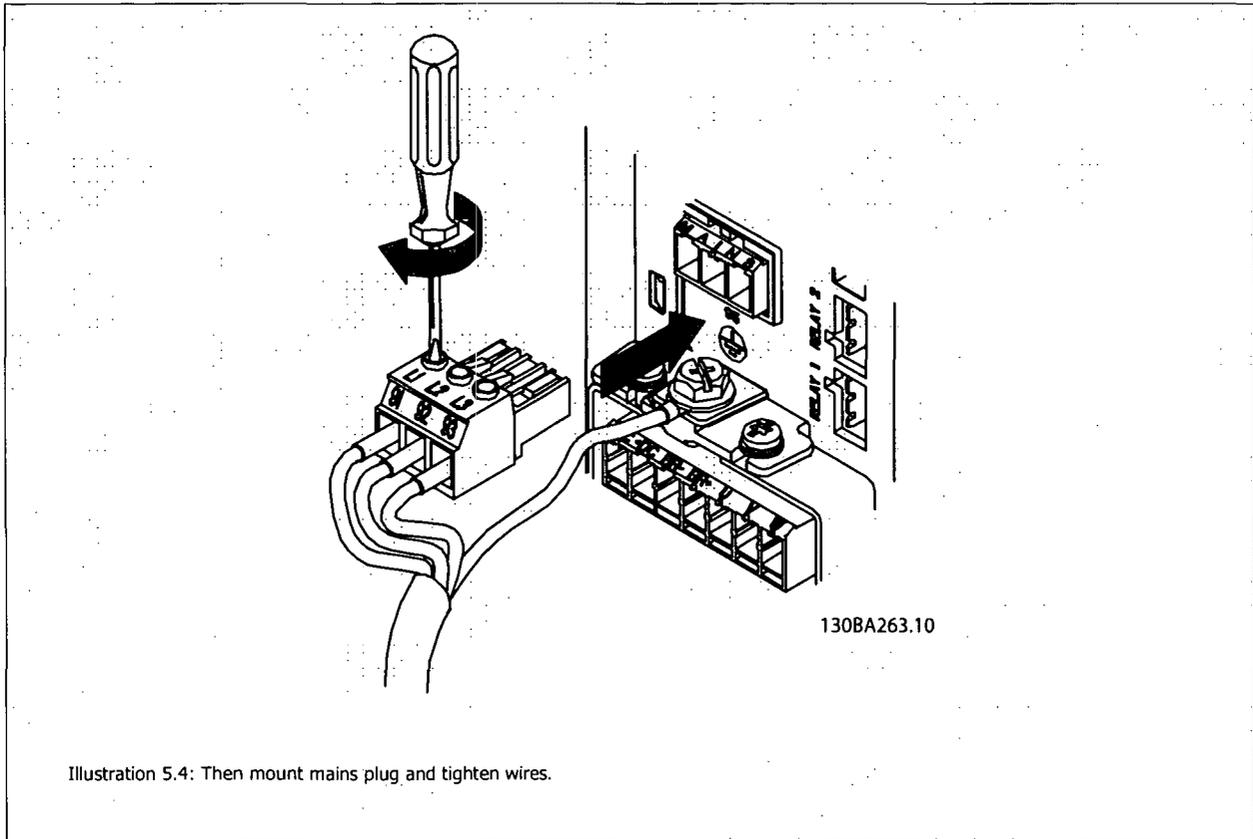


Illustration 5.4: Then mount mains plug and tighten wires.

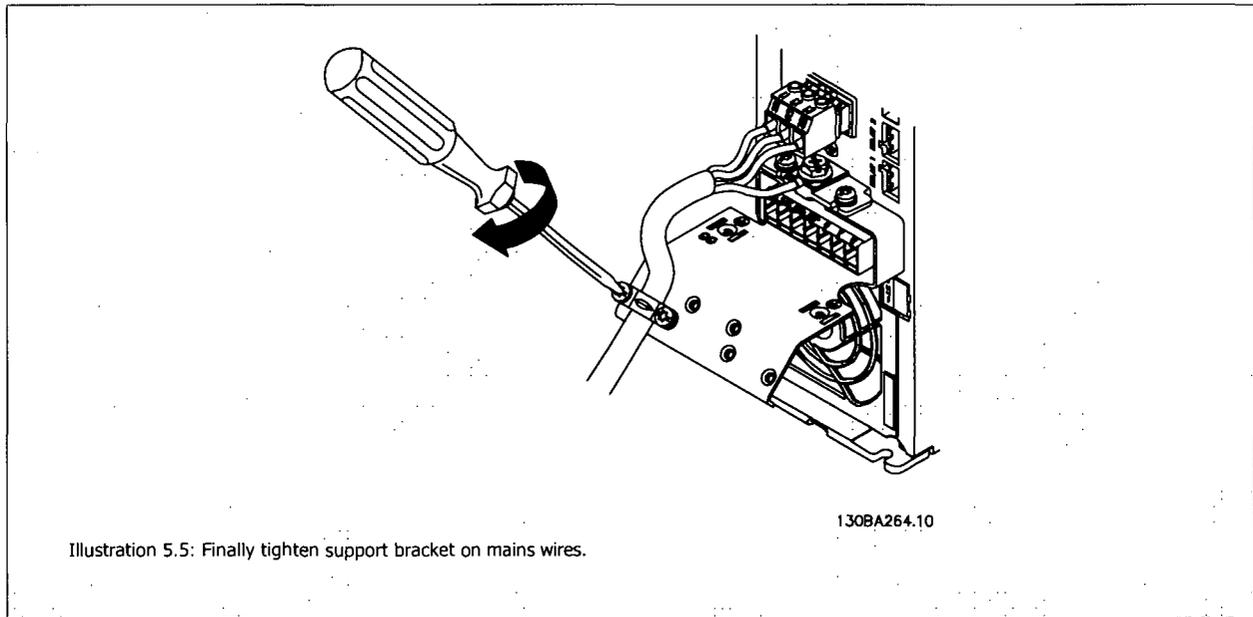


Illustration 5.5: Finally tighten support bracket on mains wires.

NB!
With single phase A3 use L1 and L2 terminals.

5 Electrical Installation

5.1.5 Mains connection for A5

5

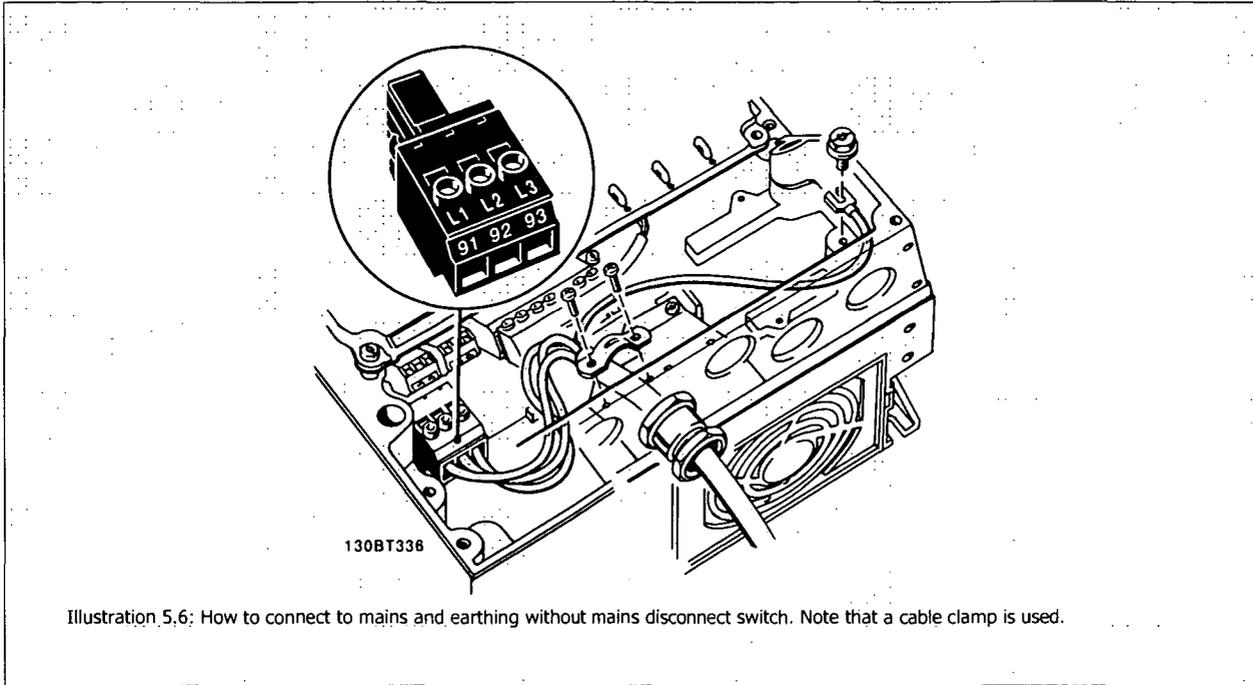


Illustration 5.6: How to connect to mains and earthing without mains disconnect switch. Note that a cable clamp is used.

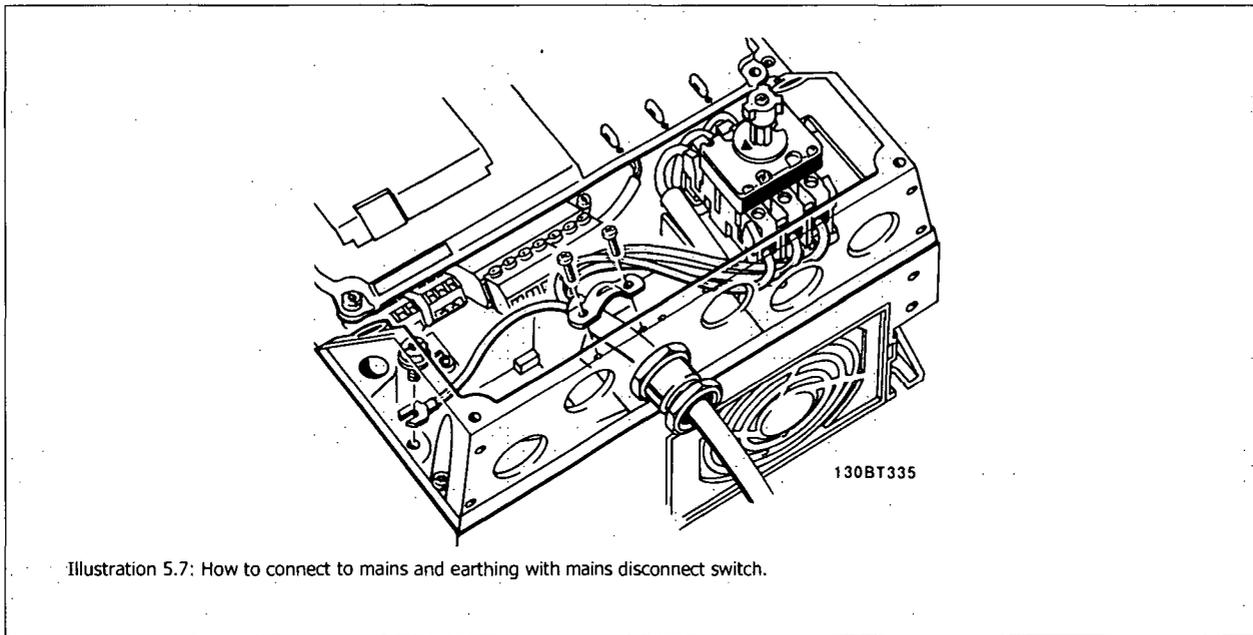


Illustration 5.7: How to connect to mains and earthing with mains disconnect switch.

NB!

With single phase A5 use L1 and L2 terminals.

5.1.6 Mains connection for B1, B2 and B3

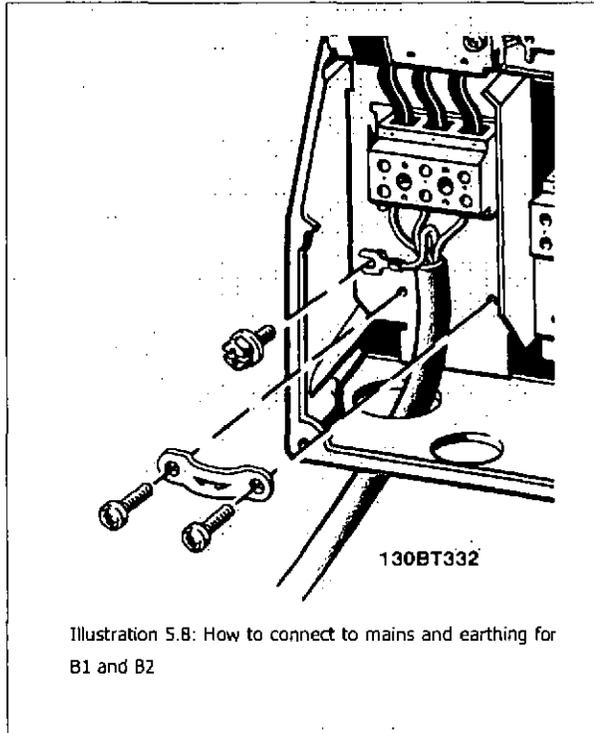


Illustration 5.8: How to connect to mains and earthing for B1 and B2

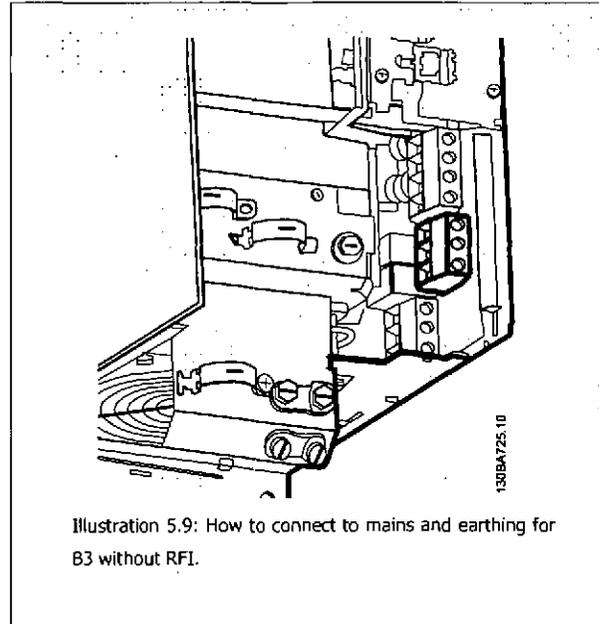


Illustration 5.9: How to connect to mains and earthing for B3 without RFI.

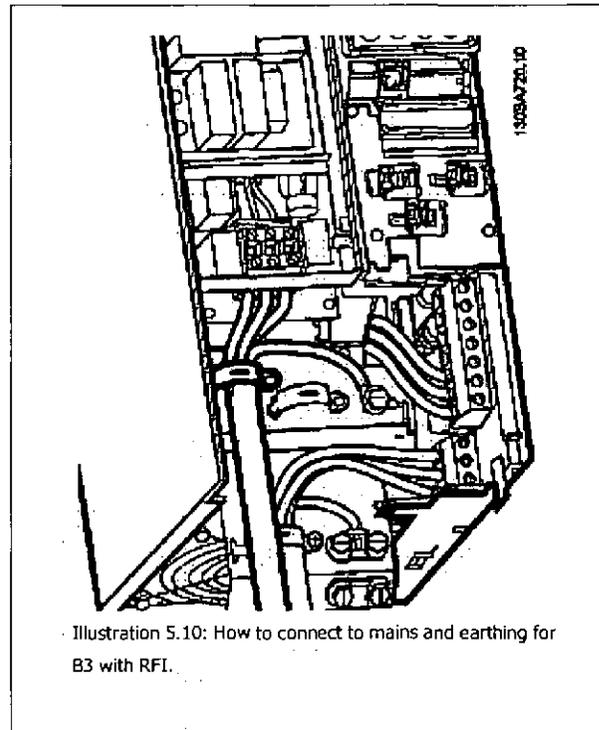


Illustration 5.10: How to connect to mains and earthing for B3 with RFI.

NB!
 With single phase B1 use L1 and L2 terminals.

 **NB!**
 For correct cable dimensions please see the section *General Specifications* at the back of this manual.



5.1.7 Mains connection for B4, C1 and C2

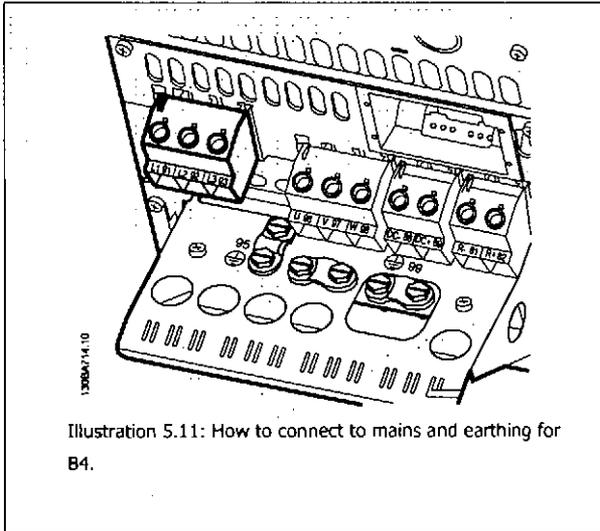


Illustration 5.11: How to connect to mains and earthing for B4.

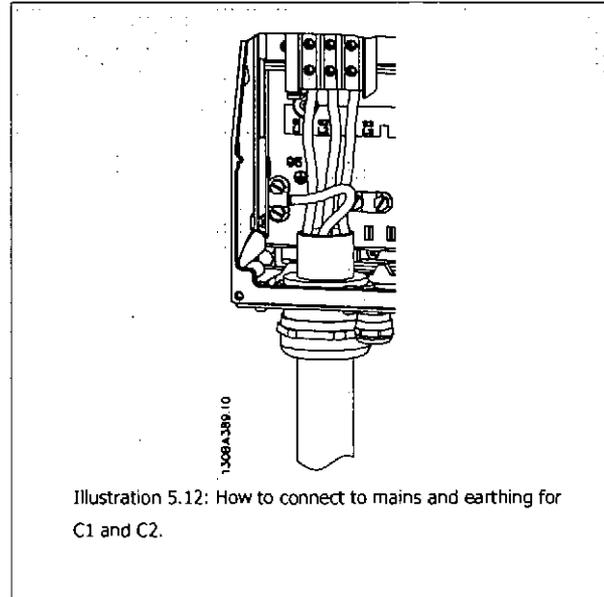


Illustration 5.12: How to connect to mains and earthing for C1 and C2.

5.1.8 Mains connection for C3 and C4

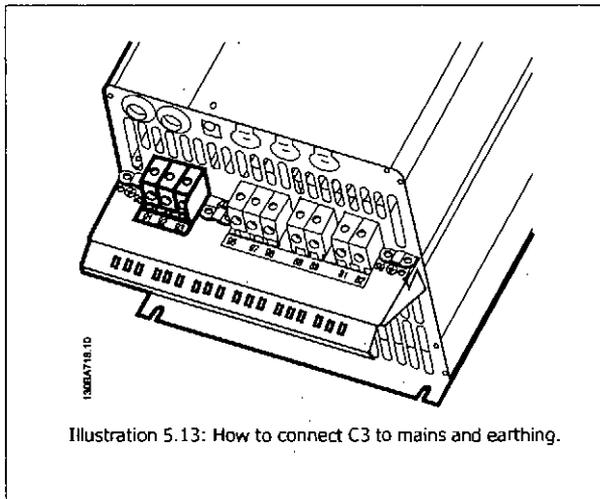


Illustration 5.13: How to connect C3 to mains and earthing.

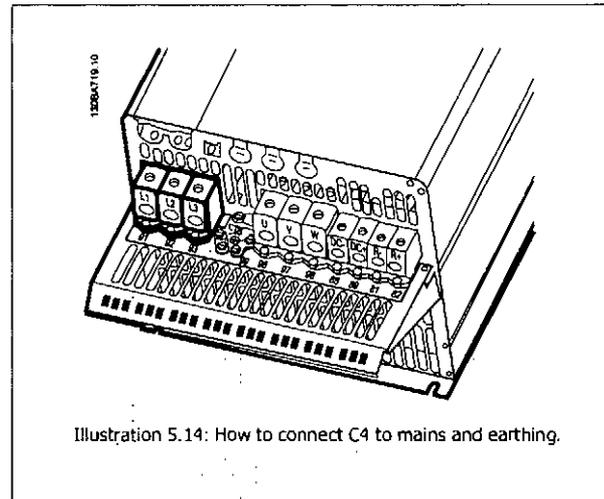


Illustration 5.14: How to connect C4 to mains and earthing.

5



5.1.9 How to connect motor - introduction

See section *General Specifications* for correct dimensioning of motor cable cross-section and length.

- Use a screened/armoured motor cable to comply with EMC emission specifications (or install the cable in metal conduit).
- Keep the motor cable as short as possible to reduce the noise level and leakage currents.
- Connect the motor cable screen/armour to both the decoupling plate of the frequency converter and to the metal of the motor. (Same applies to both ends of metal conduit if used instead of screen.)
- Make the screen connections with the largest possible surface area (cable clamp or by using an EMC cable gland). This is done by using the supplied installation devices in the frequency converter.
- Avoid terminating the screen by twisting the ends (pigtailed), as this will spoil high frequency screening effects.
- If it is necessary to break the continuity of the screen to install a motor isolator or motor relay, the continuity must be maintained with the lowest possible HF impedance.

Cable length and cross-section

The frequency converter has been tested with a given length of cable and a given cross-section of that cable. If the cross-section is increased, the cable capacitance - and thus the leakage current - may increase, and the cable length must be reduced correspondingly.

Switching frequency

When frequency converters are used together with sine wave filters to reduce the acoustic noise from a motor, the switching frequency must be set according to the sine wave filter instruction in par. 14-01 *Switching Frequency*.

Precautions while using Aluminium conductors

Aluminium conductors are not recommended for cable cross sections below 35 mm². Terminals can accept aluminium conductors but the conductor surface has to be clean and the oxidation must be removed and sealed by neutral acid free Vaseline grease before the conductor is connected. Furthermore, the terminal screw must be retightened after two days due to the softness of the aluminium. It is crucial to ensure the connection makes a gas tight joint, otherwise the aluminium surface will oxidize again.

All types of three-phase asynchronous standard motors can be connected to the frequency converter. Normally, small motors are star-connected (230/400 V, D/Y). Large motors are delta-connected (400/690 V, D/Y). Refer to the motor name plate for correct connection mode and voltage.

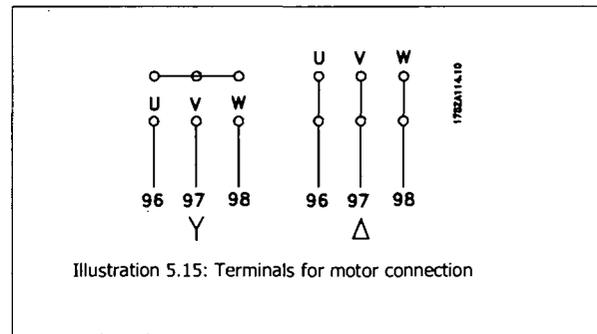


Illustration 5.15: Terminals for motor connection

NB! In motors without phase insulation paper or other insulation reinforcement suitable for operation with voltage supply (such as a frequency converter), fit a sine-wave filter on the output of the frequency converter. (Motors that comply with IEC 60034-17 do not require a Sine-wave filter).

No.	96	97	98	Motor voltage 0-100% of mains voltage.
	U	V	W	3 cables out of motor
	U1	V1	W1	6 cables out of motor, Delta-connected
	W2	U2	V2	
	U1	V1	W1	6 cables out of motor, Star-connected
				U2, V2, W2 to be interconnected separately (optional terminal block)
No.	99			Earth connection
	PE			

Table 5.3: 3 and 6 cable motor connection.

5.1.10 Motor wiring overview

Enclosure:	A2 (IP 20/IP 21)	A3 (IP 20/IP 21)	A5 (IP 55/IP 66)	B1 (IP 21/IP 55/ IP 66)	B2 (IP 21/IP 55/ IP 66)	B3 (IP 20)	B4 (IP 20)	C1 (IP 21/IP 55/66)	C2 (IP 21/IP 55/66)	C3 (IP 20)	C4 (IP20)
											
Motor size (kW):											
200-240 V	0.25-3.0	3.7	1.1-3.7	5.5-11	15	5.5-11	15-18.5	18.5-30	37-45	22-30	37-45
380-480 V	0.37-4.0	5.5-7.5	1.1-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
525-600 V		1.1-7.5	1.1-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
525-690 V					11-30				37-90		
Goto:	5.1.13		5.1.14	5.1.15		5.1.16		5.1.17		5.1.18	

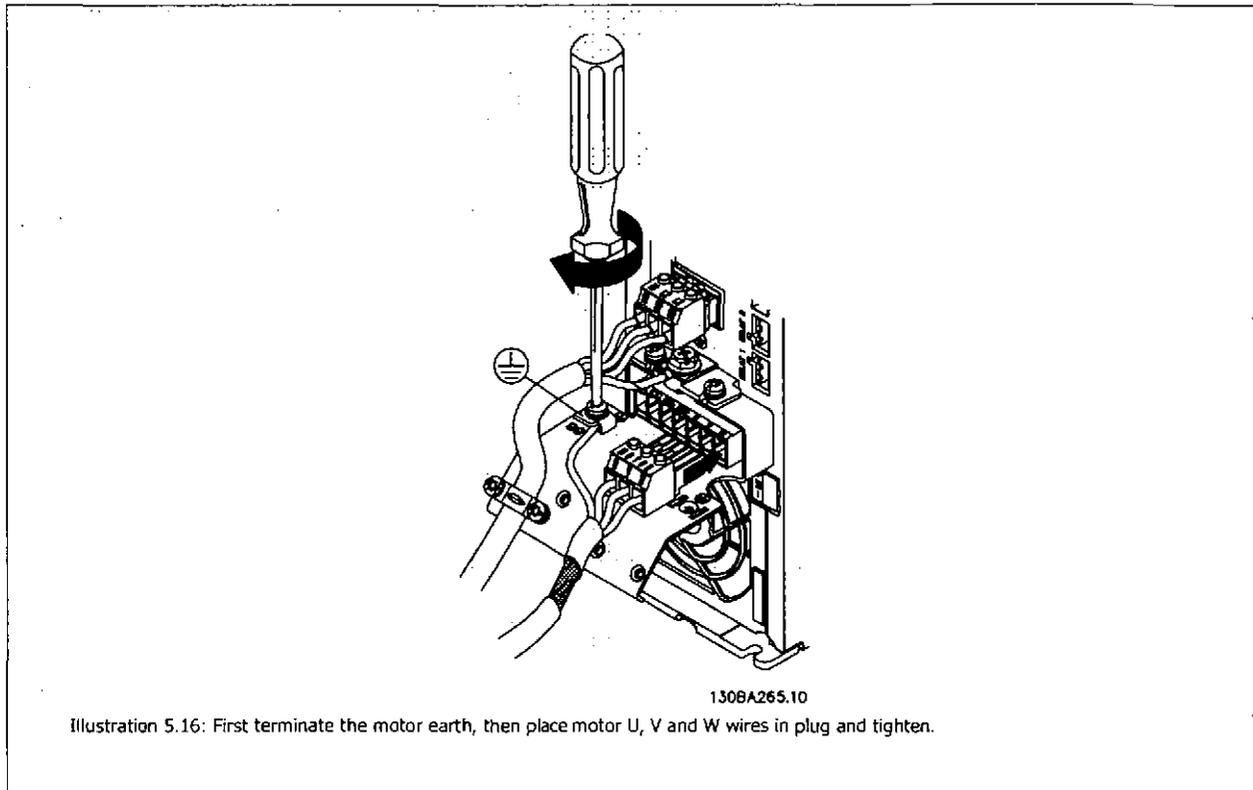
Table 5.4: Motor wiring table.

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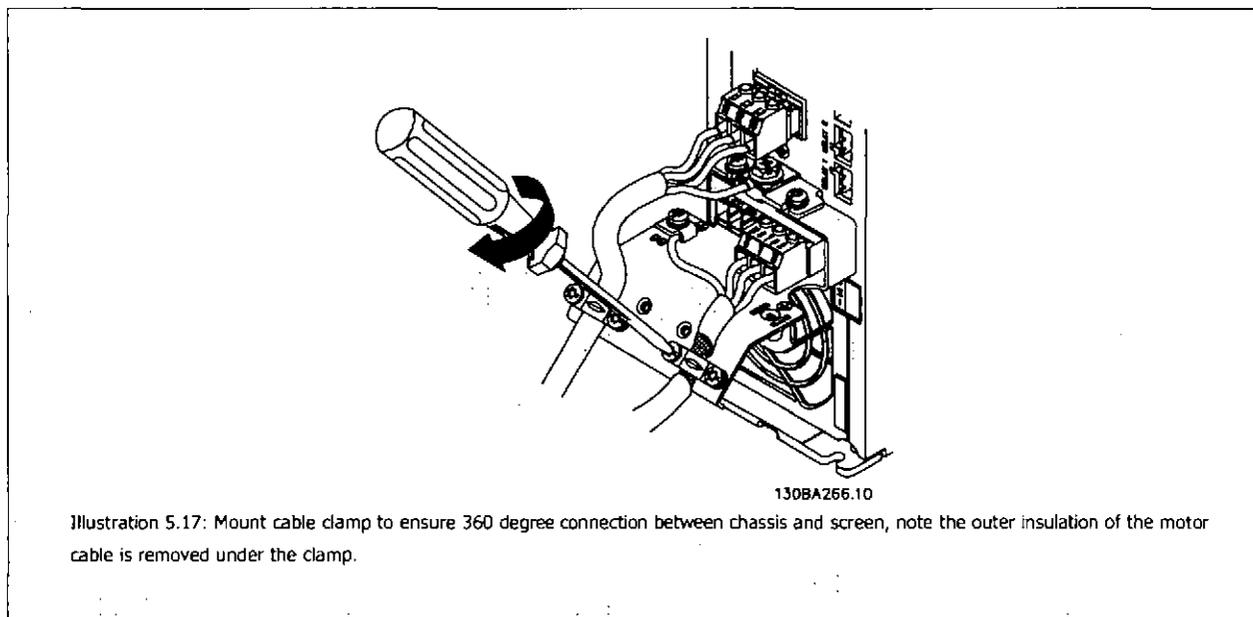


5.1.11 Motor connection for A2 and A3

Follow these drawings step by step for connecting the motor to the frequency converter.



5



5.1.12 Motor connection for A5

5

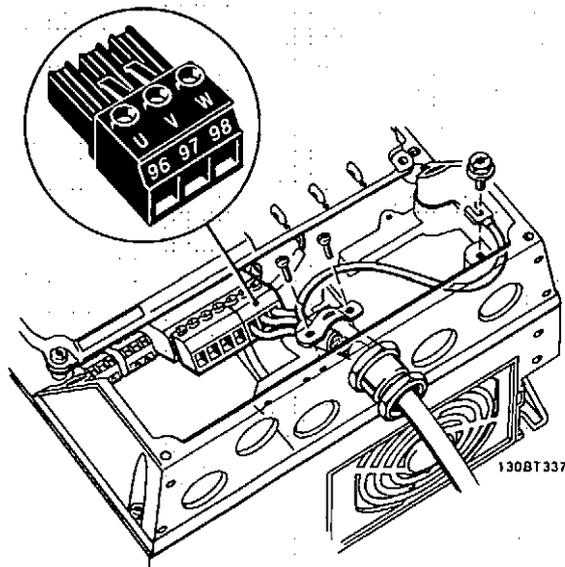


Illustration 5.18: First terminate the motor earth, then place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5.1.13 Motor connection for B1 and B2

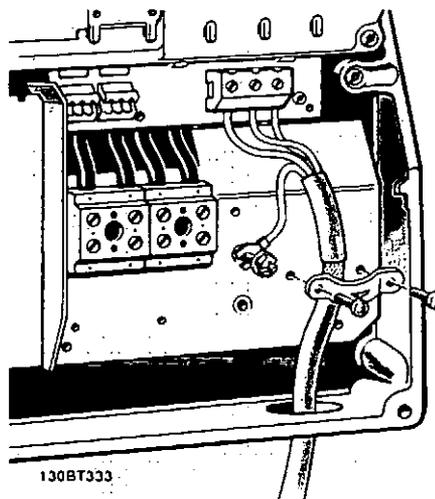


Illustration 5.19: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5.1.14 Motor connection for B3 and B4

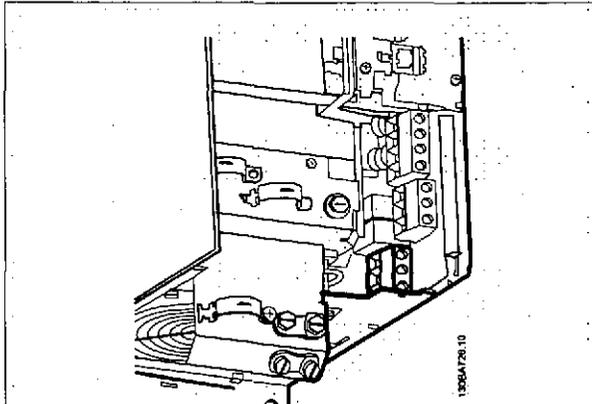


Illustration 5.20: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

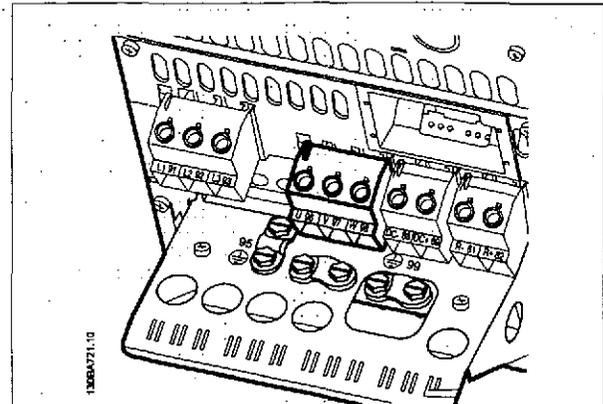


Illustration 5.21: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5

5.1.15 Motor connection for C1 and C2

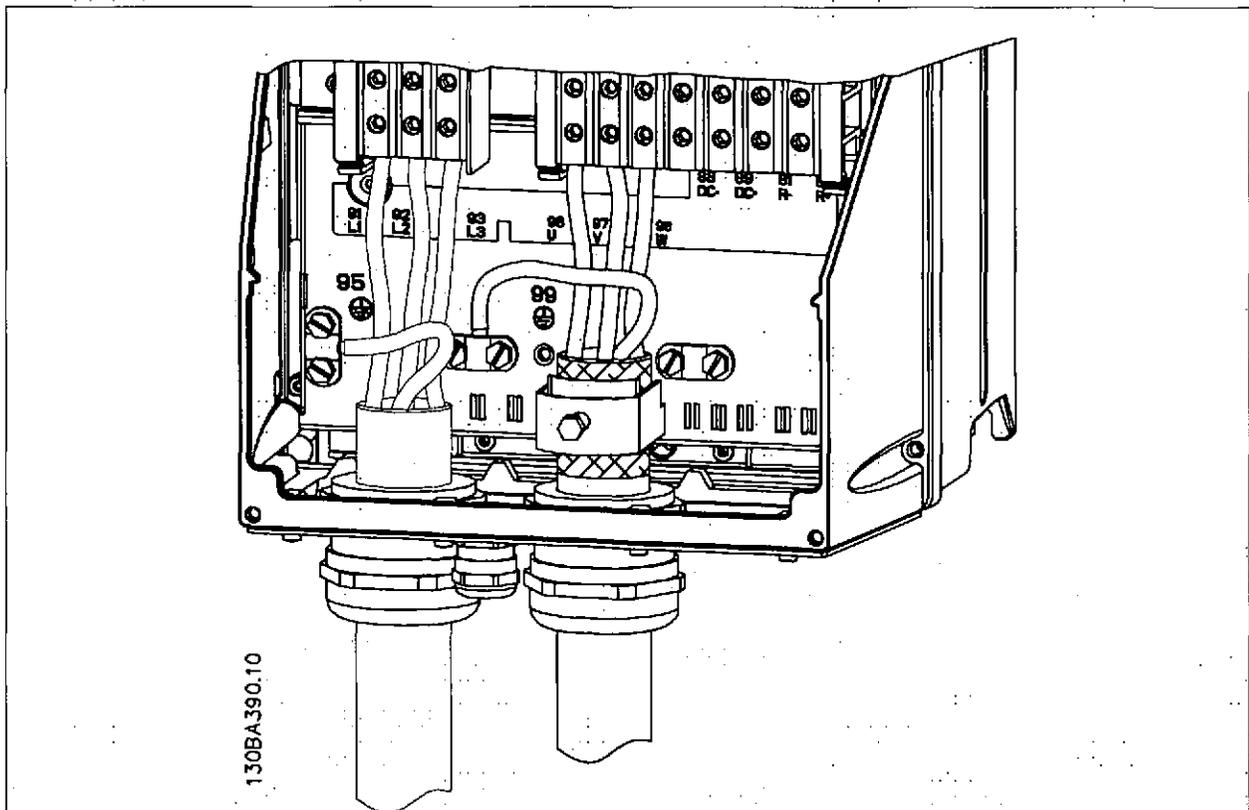


Illustration 5.22: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5.1.16 Motor connection for C3 and C4

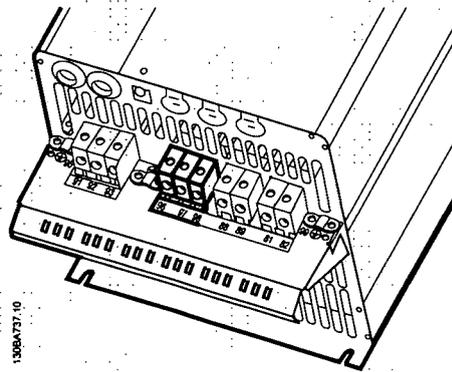


Illustration 5.23: First terminate the motor earth, then place motor U, V and W wires into the appropriate terminals and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

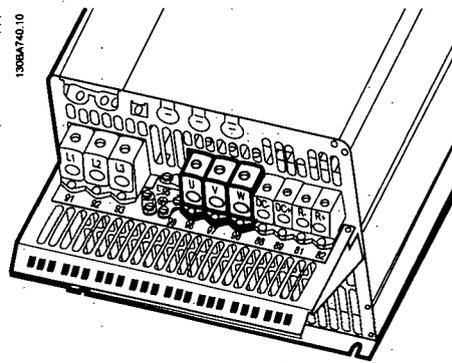


Illustration 5.24: First terminate the motor earth, then place motor U, V and W wires into the appropriate terminals and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5.1.17 DC bus connection

The DC bus terminal is used for DC back-up, with the intermediate circuit being supplied from an external source.

Terminal numbers used: 88, 89

5

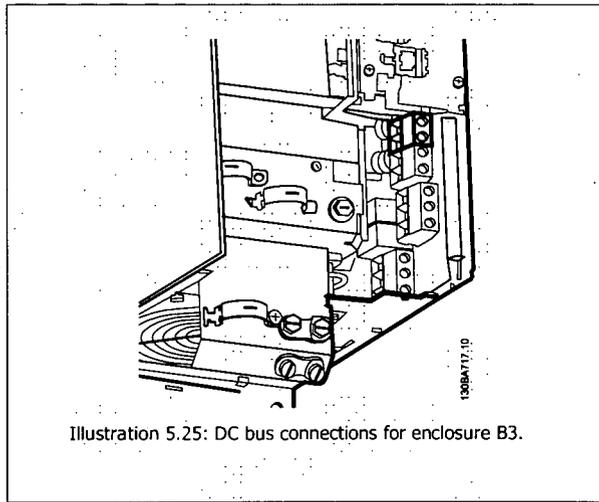


Illustration 5.25: DC bus connections for enclosure B3.

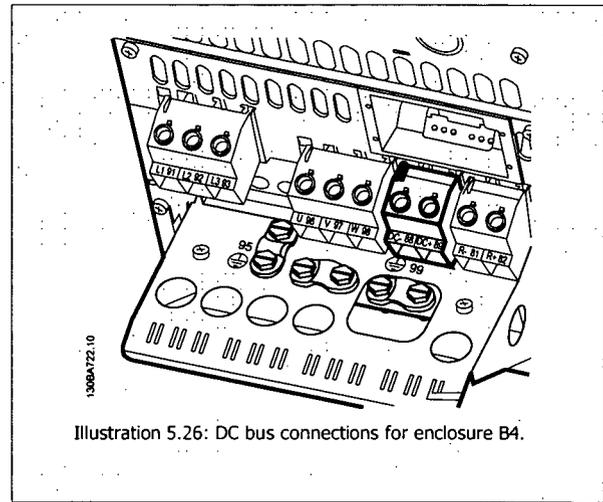


Illustration 5.26: DC bus connections for enclosure B4.

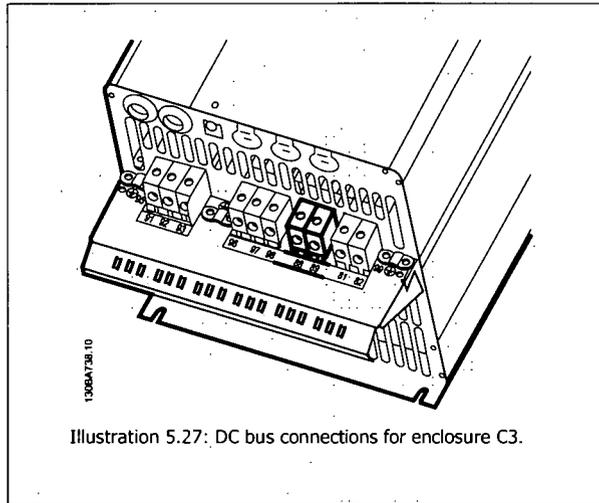


Illustration 5.27: DC bus connections for enclosure C3.

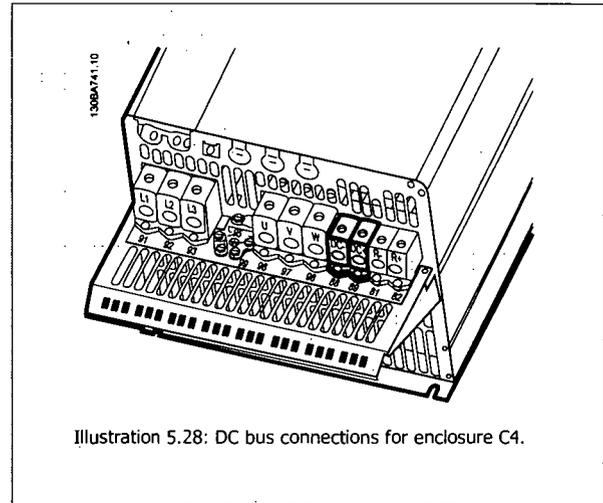


Illustration 5.28: DC bus connections for enclosure C4.

Please contact Danfoss if you require further information.

5.1.18 Brake connection option

The connection cable to the brake resistor must be screened/armoured.

Brake resistor		
Terminal number	81	82
Terminals	R-	R+

NB!
 Dynamic brake calls for extra equipment and safety considerations. For further information, please contact Danfoss.

1. Use cable clamps to connect the screen to the metal cabinet of the frequency converter and to the decoupling plate of the brake resistor.
2. Dimension the cross-section of the brake cable to match the brake current.

NB!
 Voltages up to 975 V DC (@ 600 V AC) may occur between the terminals.

5 Electrical Installation

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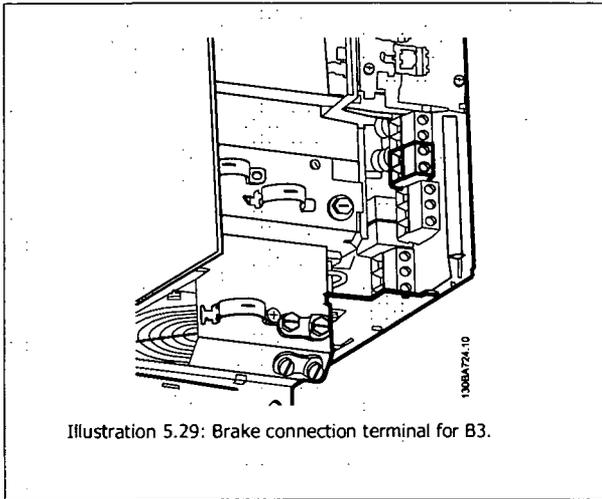


Illustration 5.29: Brake connection terminal for B3.

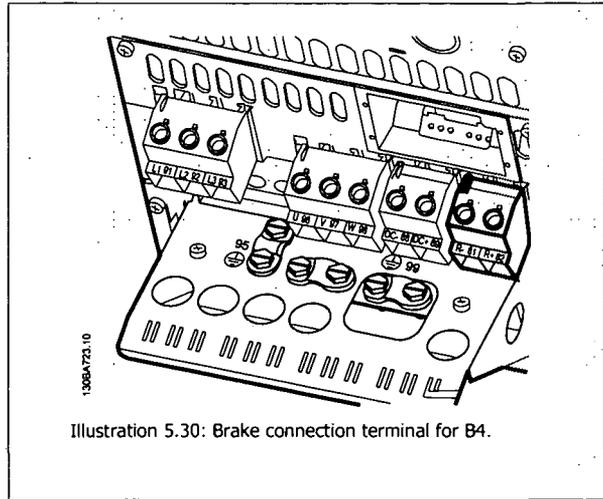


Illustration 5.30: Brake connection terminal for B4.

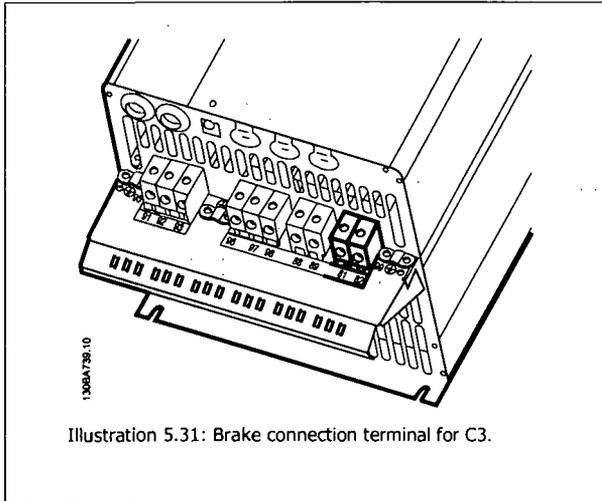


Illustration 5.31: Brake connection terminal for C3.

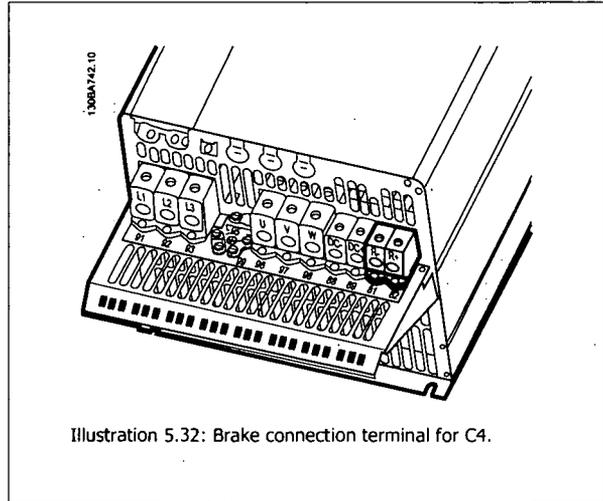


Illustration 5.32: Brake connection terminal for C4.

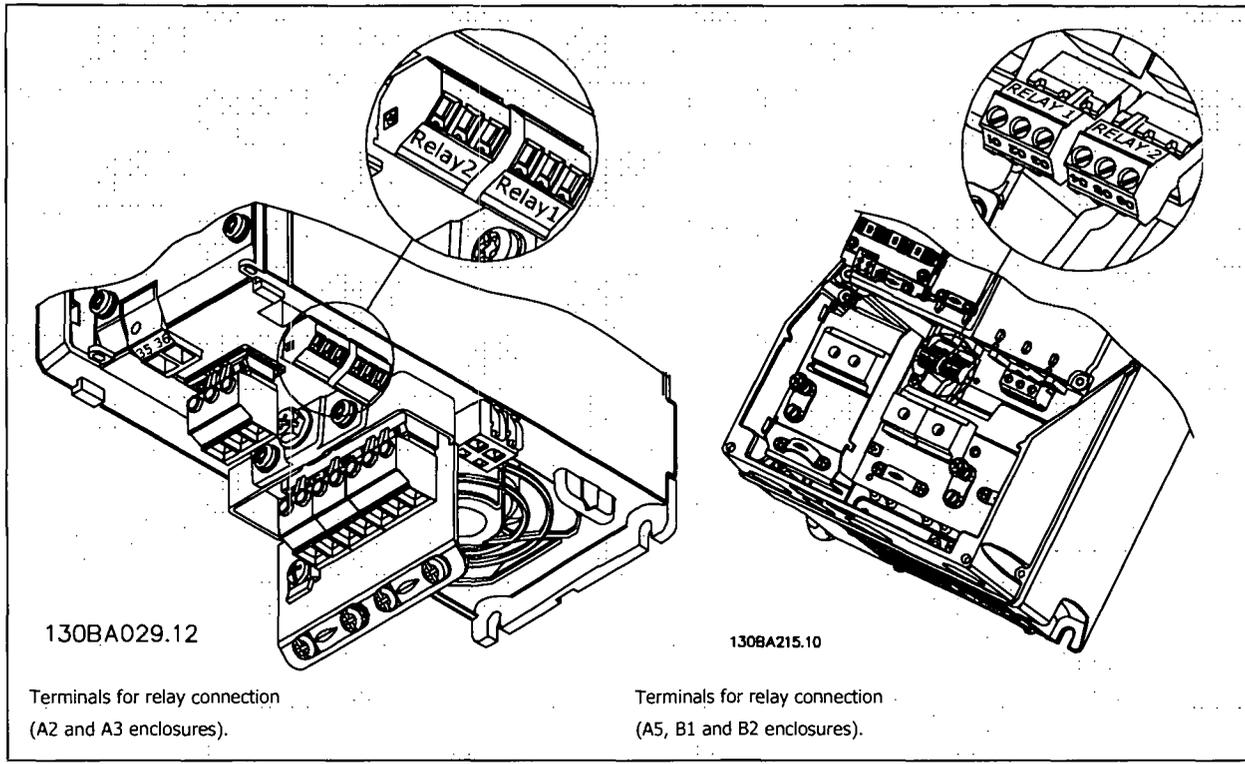
NB!
If a short circuit in the brake IGBT occurs, prevent power dissipation in the brake resistor by using a mains switch or contactor to disconnect the mains for the frequency converter. Only the frequency converter shall control the contactor.

NB!
Place the brake resistor in an environment free of fire risk and ensure that no external objects can fall into the brake resistor through ventilation slots.
Do not cover ventilation slots and grids.

5.1.19 Relay connection

To set relay output, see par. group 5-4* Relays.

No.	01 - 02	make (normally open)
	01 - 03	break (normally closed)
	04 - 05	make (normally open)
	04 - 06	break (normally closed)

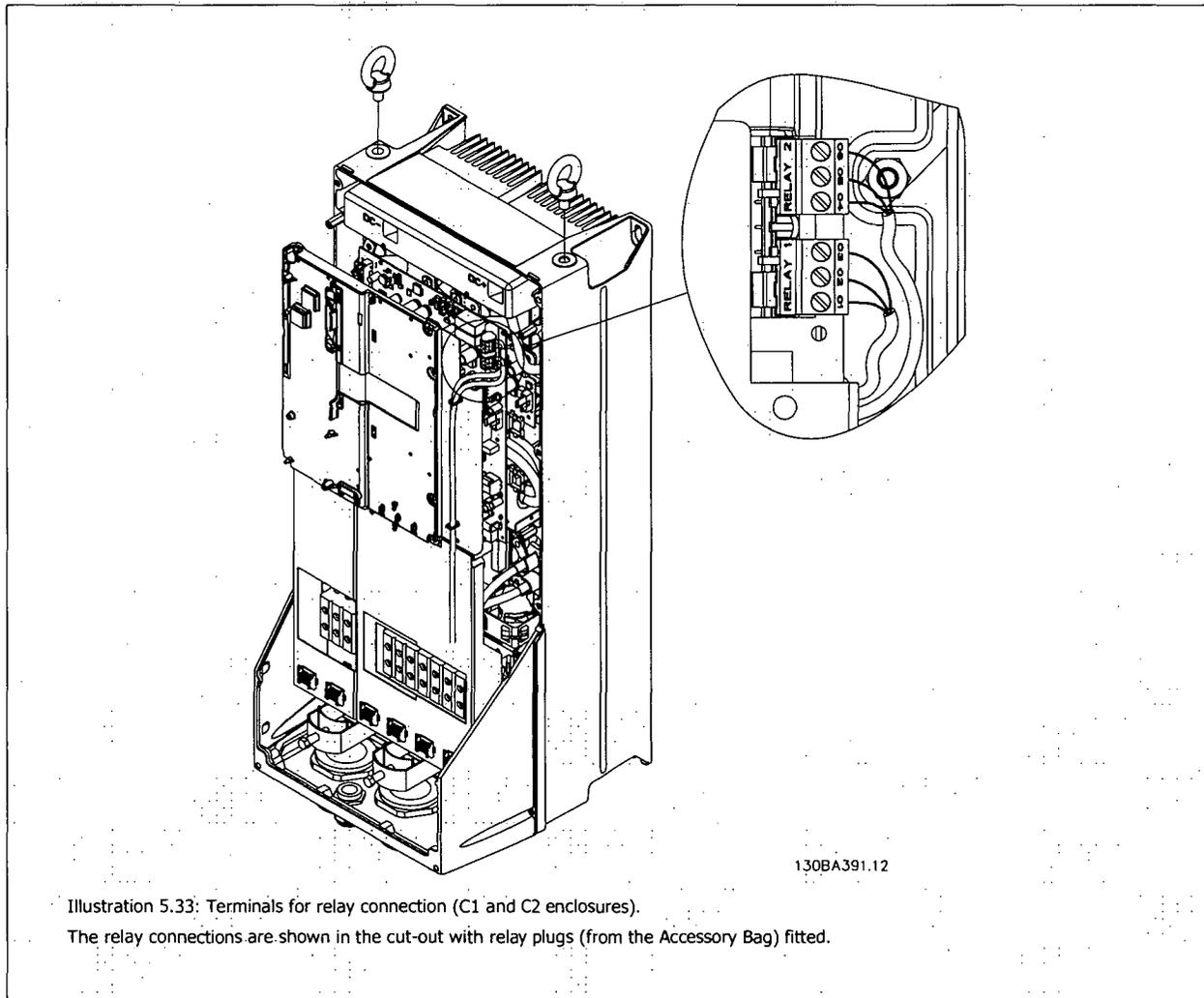


130BA029.12

Terminals for relay connection
(A2 and A3 enclosures).

130BA215.10

Terminals for relay connection
(A5, B1 and B2 enclosures).



130BA391.12

Illustration 5.33: Terminals for relay connection (C1 and C2 enclosures).
 The relay connections are shown in the cut-out with relay plugs (from the Accessory Bag) fitted.

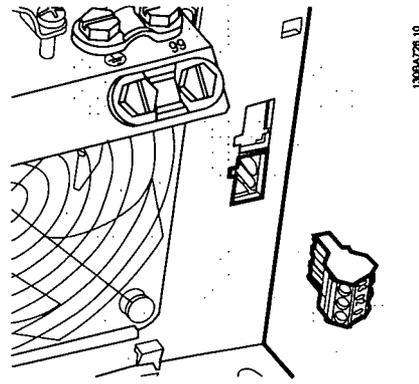


Illustration 5.34: Terminals for relay connections for B3. Only one relay input is fitted from the factory. When the second relay is needed remove knock-out.

5

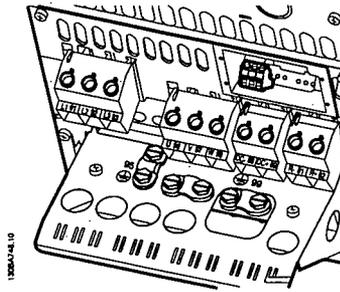


Illustration 5.35: Terminals for relay connections for B4.

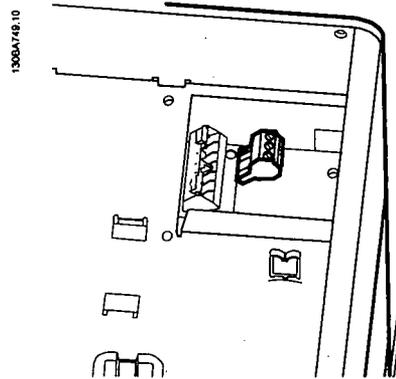


Illustration 5.36: Terminals for relay connections for C3 and C4. Located in the upper right corner of the frequency converter.

5.1.20 Relay output

Relay 1

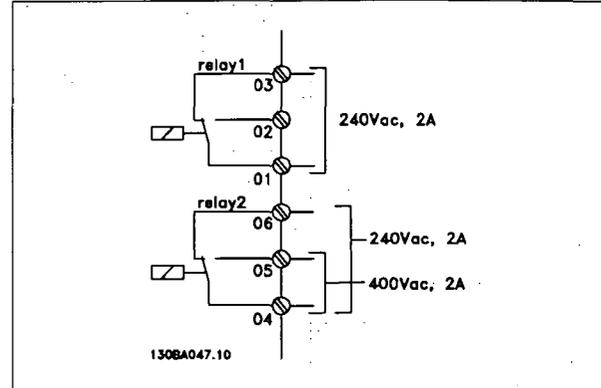
- Terminal 01: common
- Terminal 02: normal open 240 V AC
- Terminal 03: normal closed 240 V AC

Relay 1 and relay 2 are programmed in par. 5-40 *Function Relay*, par. 5-41 *On Delay, Relay*, and par. 5-42 *Off Delay, Relay*.

Additional relay outputs by using option module MCB 105.

Relay 2

- Terminal 04: common
- Terminal 05: normal open 400 V AC
- Terminal 06: normal closed 240 V AC



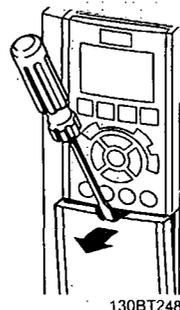
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5.1.21 Wiring example and testing

The following section describes how to terminate control wires and how to access them. For an explanation of the function, programming and wiring of the control terminals, please see chapter, *How to programme the frequency converter*.

5.1.22 Access to control terminals

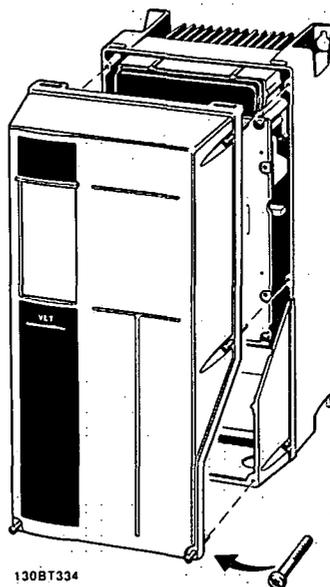
All terminals to the control cables are located underneath the terminal cover on the front of the frequency converter. Remove the terminal cover with a screwdriver.



130BT248

Illustration 5.37: Access to control terminals for A2, A3, B3, B4, C3 and C4 enclosures

Remove front-cover to access control terminals. When replacing the front-cover, please ensure proper fastening by applying a torque of 2 Nm.



130BT334

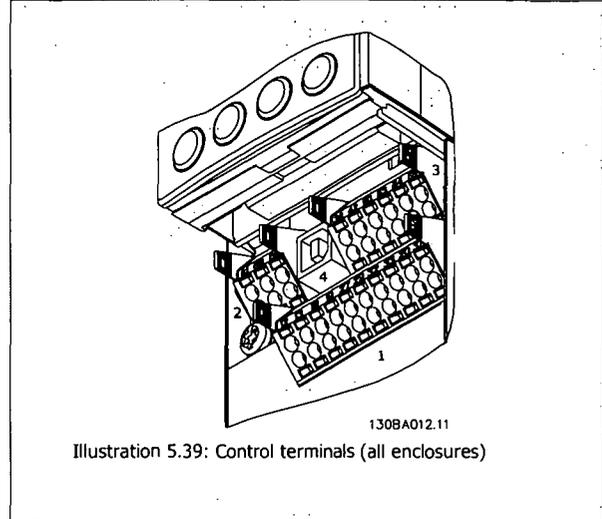
Illustration 5.38: Access to control terminals for A5, B1, B2, C1 and C2 enclosures

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5.1.23 Control terminals

Drawing reference numbers:

1. 10-pole plug digital I/O.
2. 3-pole plug RS-485 Bus.
3. 6-pole analog I/O.
4. USB connection.

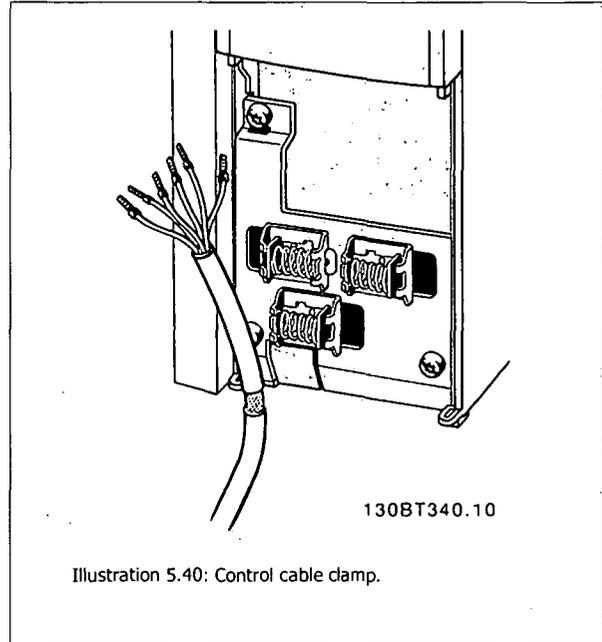


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5.1.24 Control cable clamp

1. Use a clamp from the accessory bag to connect screen to frequency converter decoupling plate for control cables.

See section entitled *Earthing of Screened/Armoured Control Cables* for the correct termination of control cables.





5.1.25 Electrical installation and control cables

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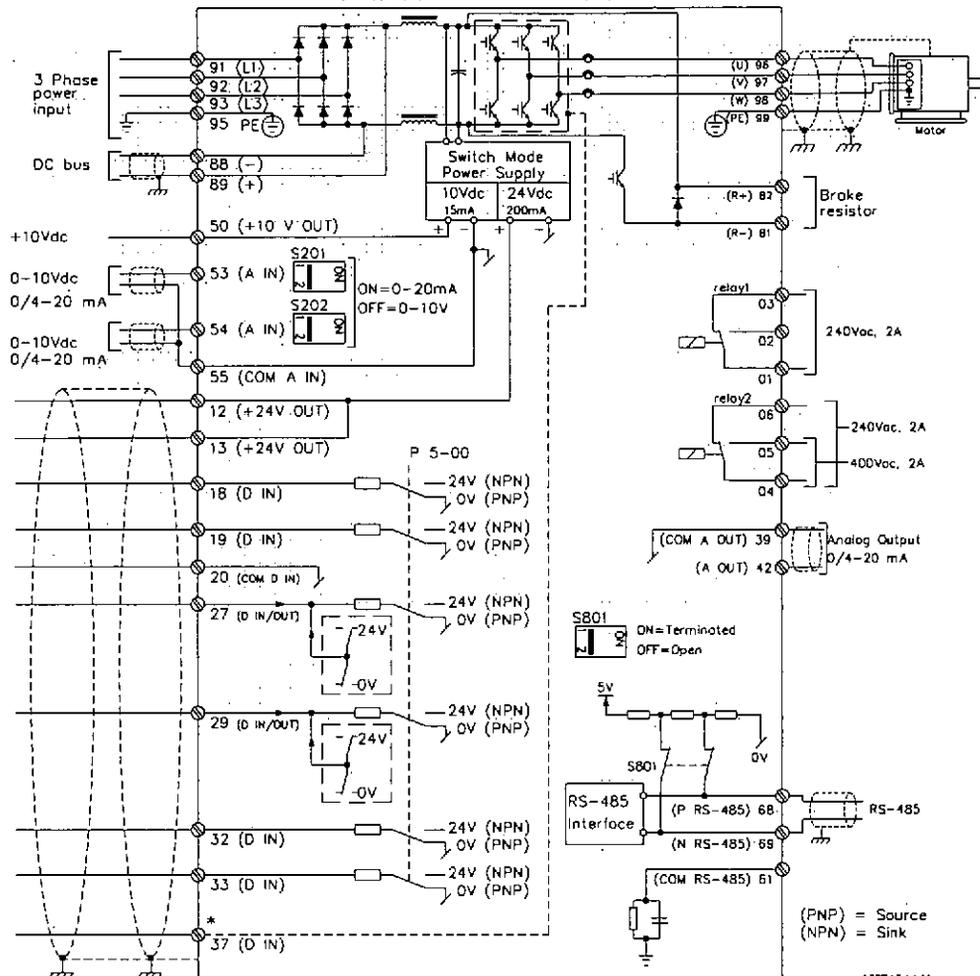


Illustration 5.41: Diagram showing all electrical terminals. (Terminal 37 present for units with Safe Stop Function only.)

Terminal number	Terminal description	Parameter number	Factory default
1+2+3	Terminal 1+2+3-Relay1	5-40	No operation
4+5+6	Terminal 4+5+6-Relay2	5-40	No operation
12	Terminal 12 Supply		+24 V DC
13	Terminal 13 Supply		+24 V DC
18	Terminal 18 Digital Input	5-10	Start
19	Terminal 19 Digital Input	5-11	No operation
20	Terminal 20		Common
27	Terminal 27 Digital Input/Output	5-12/5-30	Coast inverse
29	Terminal 29 Digital Input/Output	5-13/5-31	Jog
32	Terminal 32 Digital Input	5-14	No operation
33	Terminal 33 Digital Input	5-15	No operation
37	Terminal 37 Digital Input		Safe Stop
42	Terminal 42 Analog Output	6-50	Speed 0-HighLim
53	Terminal 53 Analog Input	3-15/6-1*/20-0*	Reference
54	Terminal 54 Analog Input	3-15/6-2*/20-0*	Feedback

Table 5.5: Terminal connections

Very long control cables and analog signals may, in rare cases and depending on installation, result in 50/60 Hz earth loops due to noise from mains supply cables.

If this occurs, break the screen or insert a 100 nF capacitor between screen and chassis.



NB!
 The common of digital / analog inputs and outputs should be connected to separate common terminals 20, 39, and 55. This will avoid ground current interference among groups. For example, it avoids switching on digital inputs disturbing analog inputs.



NB!
 Control cables must be screened/armoured.

5.1.26 How to test motor and direction of rotation



Note that unintended motor start can occur, ensure no personnel or equipment is in danger!

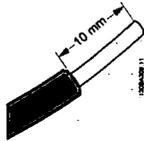


Illustration 5.42:
Step 1: First remove the insulation on both ends of a 50 to 70 mm piece of wire.

Please follow these steps to test the motor connection and direction of rotation. Start with no power to the unit.

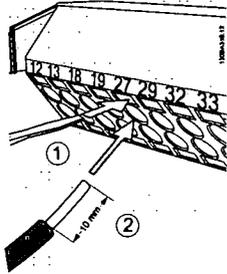


Illustration 5.43:
Step 2: Insert one end in terminal 27 using a suitable terminal screwdriver. (Note: For units with Safe Stop function, the existing jumper between terminal 12 and 37 should not be removed for the unit to be able to run!)

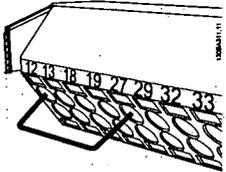


Illustration 5.44:
Step 3: Insert the other end in terminal 12 or 13. (Note: For units with Safe Stop function, the existing jumper between terminal 12 and 37 should not be removed for the unit to be able to run!)

5 Electrical Installation

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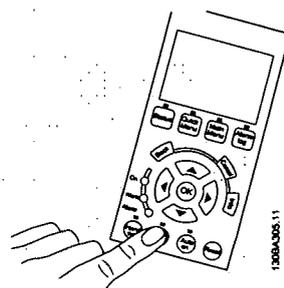


Illustration 5.45:

Step 4: Power-up the unit and press the [Off] button. In this state the motor should not rotate. Press [Off] to stop the motor at any time. Note the LED at the [OFF] button should be lit. If alarms or warnings are flashing, please see chapter 7 regarding these.

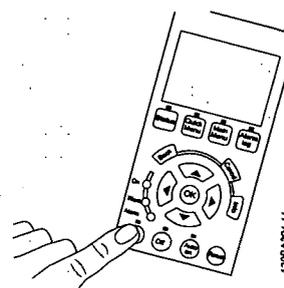


Illustration 5.46:

Step 5: By pressing the [Hand on] button, the LED above the button should be lit and the motor may rotate.

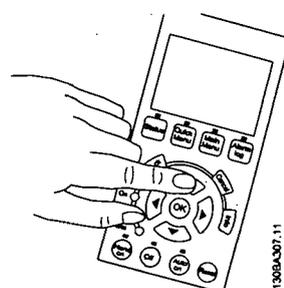


Illustration 5.47:

Step 6: The speed of the motor can be seen in the LCP. It can be adjusted by pushing the up ▲ and down ▼ arrow buttons.

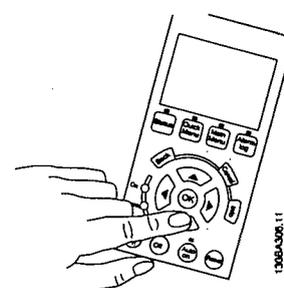


Illustration 5.48:

Step 7: To move the cursor, use the left ◀ and right ▶ arrow buttons. This enables changing the speed in larger increments.

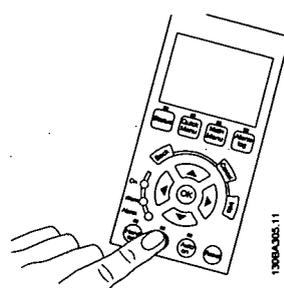


Illustration 5.49:

Step 8: Press the [Off] button to stop the motor again.

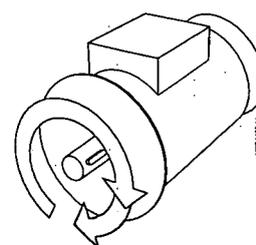


Illustration 5.50:

Step 9: Change two motor wires if the desired rotation of direction is not achieved.



Remove mains power from the frequency converter before changing motor wires.

5.1.27 Switches S201, S202, and S801

Switches S201 (AI 53) and S202 (AI 54) are used to select a current (0-20 mA) or a voltage (0 to 10 V) configuration of the analog input terminals 53 and 54 respectively.

Switch S801 (BUS TER.) can be used to enable termination on the RS-485 port (terminals 68 and 69).

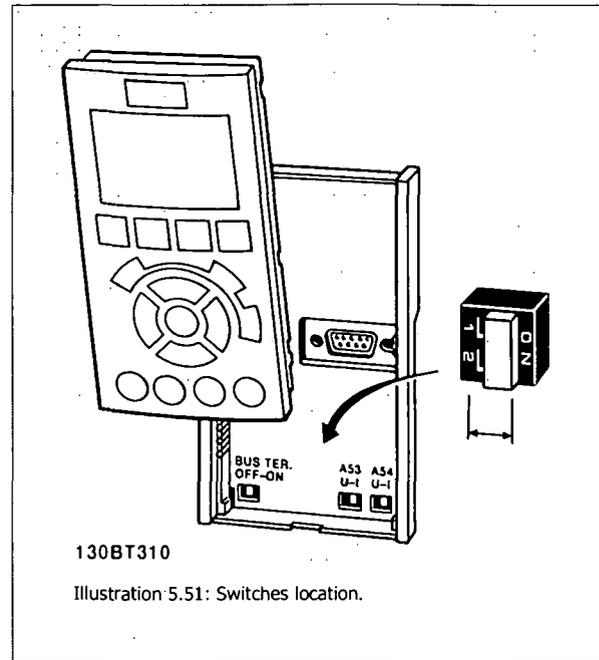
Please note that the switches may be covered by an option, if fitted.

Default setting:

S201 (AI 53) = OFF (voltage input)

S202 (AI 54) = OFF (voltage input)

S801 (Bus termination) = OFF



5.2 Final Optimization and Test

5.2.1 Final optimization and test

To optimize motor shaft performance and optimize the frequency converter for the connected motor and installation, please follow these steps. Ensure that frequency converter and motor are connected, and power is applied to frequency converter.

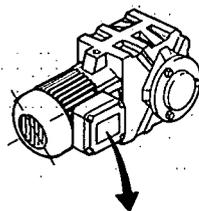
NB!
 Before power up ensure that connected equipment is ready for use.

Step 1. Locate motor name plate

NB!
 The motor is either star- (Y) or delta- connected (Δ). This information is located on the motor name plate data.



5 Electrical Installation



3 ~ MOTOR NR. 182/521 2003	
B/E00244	
	1.3 kW
U _n 314	500 V
f _n 1400	50 Hz
cos φ 0.88	3.6 A
I _{FL}	
IP 55	HTFA
1308T107	

Illustration 5.52: Motor name plate example

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Step 2. Enter motor name plate data in following parameter list.

To access list first press [QUICK MENU] key then select "Q2 Quick Setup".

1.	Motor Power [kW] or Motor Power [HP]	par. 1-20 par. 1-21
2.	Motor Voltage	par. 1-22
3.	Motor Frequency	par. 1-23
4.	Motor Current	par. 1-24
5.	Motor Nominal Speed	par. 1-25

Table 5.6: Motor related parameters

Step 3. Activate Automatic Motor Adaptation (AMA)

Performing AMA ensures best possible performance. AMA automatically takes measurements from the specific motor connected and compensates for installation variances.

1. Connect terminal 27 to terminal 12 or use [MAIN MENU] and set Terminal 27 par. 5-12 to *No operation* (par. 5-12 [0])
2. Press [QUICK MENU], select "Q2 Quick Setup", scroll down to AMA par. 1-29.
3. Press [OK] to activate the AMA par. 1-29.
4. Choose between complete or reduced AMA. If sine wave filter is mounted, run only reduced AMA, or remove sine wave filter during AMA procedure.
5. Press [OK] key. Display should show "Press [Hand on] to start".
6. Press [Hand on] key. A progress bar indicates if AMA is in progress.

Stop the AMA during operation

1. Press the [OFF] key - the frequency converter enters into alarm mode and the display shows that the AMA was terminated by the user.

Successful AMA

1. The display shows "Press [OK] to finish AMA".
2. Press the [OK] key to exit the AMA state.

Unsuccessful AMA

1. The frequency converter enters into alarm mode. A description of the alarm can be found in the *Troubleshooting* section.
2. "Report Value" in the [Alarm Log] shows the last measuring sequence carried out by the AMA, before the frequency converter entered alarm mode. This number along with the description of the alarm will assist troubleshooting. If contacting Danfoss Service, make sure to mention number and alarm description.



NB!

Unsuccessful AMA is often caused by incorrectly entered motor name plate data or too big difference between the motor power size and the frequency converter power size.



Step 4. Set speed limit and ramp time

Set up the desired limits for speed and ramp time.

Minimum Reference	par. 3-02
Maximum Reference	par. 3-03

Motor Speed Low Limit	par. 4-11 or 4-12
Motor Speed High Limit	par. 4-13 or 4-14

Ramp 1 Ramp Up Time [s]	par. 3-41
Ramp 1 Ramp Down Time 1 [s]	par. 3-42

6 Commissioning and Application Examples

6.1 Quick Setup

6.1.1 Quick Menu Mode

The GLCP provides access to all parameters listed under the Quick Menus. To set parameters using the [Quick Menu] button:

Pressing [Quick Menu] the list indicates the different areas contained in the Quick menu.

Efficient parameter set-up for water applications

The parameters can easily be set up for the vast majority of the water and wastewater applications only by using the [Quick Menu].

The optimum way to set parameters through the [Quick Menu] is by following the below steps:

1. Press [Quick Setup] for selecting basic motor settings, ramp times, etc.
2. Press [Function Setups] for setting up the required functionality of the frequency converter - if not already covered by the settings in [Quick Setup].
3. Choose between *General Settings*, *Open Loop Settings* and *Closed Loop Settings*.

It is recommended to do the set-up in the order listed.

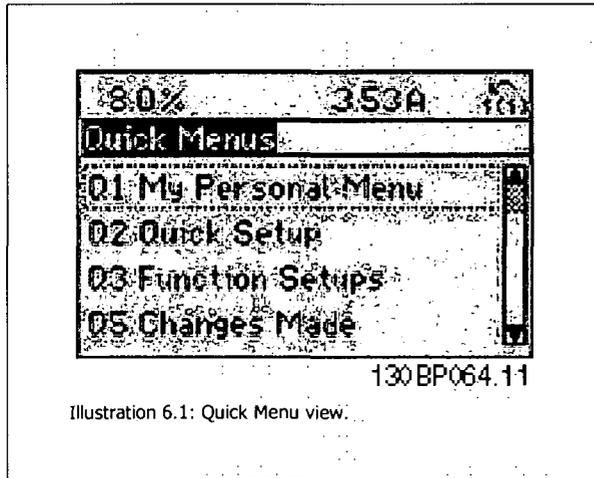


Illustration 6.1: Quick Menu view.

Par.	Designation	[Units]
0-01	Language	
1-20	Motor Power	[kW]
1-22	Motor Voltage	[V]
1-23	Motor Frequency	[Hz]
1-24	Motor Current	[A]
1-25	Motor Nominal Speed	[RPM]
3-41	Ramp 1 Ramp up Time	[s]
3-42	Ramp 1 Ramp down Time	[s]
4-11	Motor Speed Low Limit	[RPM]
4-13	Motor Speed High Limit	[RPM]
1-29	Automatic Motor Adaptation (AMA)	

Table 6.1: Quick Setup parameters. Please see section *Commonly Used Parameters - Explanations*

If *No Operation* is selected in terminal 27 no connection to +24 V on terminal 27 is necessary to enable start.

If *Coast Inverse* (factory default value) is selected in Terminal 27, a connection to +24V is necessary to enable start.

NB!

For detailed parameter descriptions, please see the following section on *Commonly Used Parameters - Explanations*.

6 Commissioning and Application Examples



6.2.1 Start/Stop

Terminal 18 = start/stop par. 5-10 [8] *Start*

Terminal 27 = No operation par. 5-12 [0] *No operation* (Default *coast inverse*)

Par. 5-10 *Digital Input*, Terminal 18 = *Start* (default):

Par. 5-12 *Digital Input*, Terminal 27 = *coast inverse* (default)

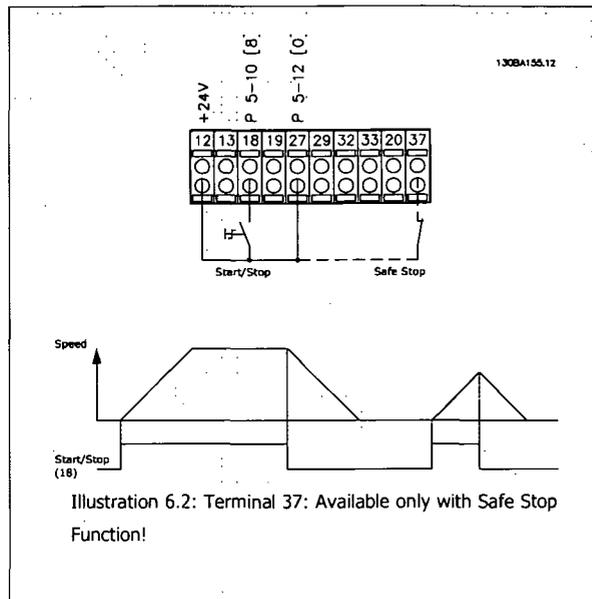


Illustration 6.2: Terminal 37: Available only with Safe Stop Function!

6

6.2.2 Closed loop wiring

Terminal 12 /13: +24V DC

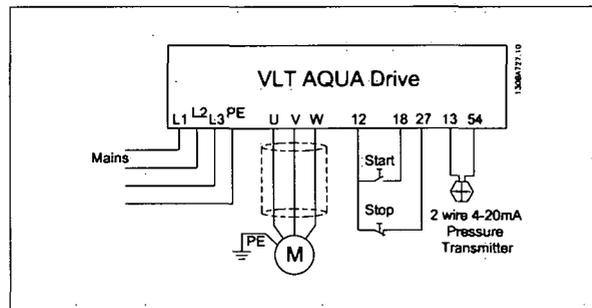
Terminal 18: Start par. 5-18 [8] *Start* (Default)

Terminal 27: Coast par. 5-12 [2] *coast inverse* (Default)

Terminal 54: Analog input

L1-L3: Mains terminals

U,V and W: Motor terminals



6.2.3 Submersible pump application

The system consists of a submersible pump controlled by a Danfoss VLT AQUA Drive and a pressure transmitter. The transmitter gives a 4-20 mA feedback signal to the VLT AQUA Drive, which keeps a constant pressure by controlling the speed of the pump. To design a drive for a submersible pump application, there are a few important issues to take into consideration. Therefore the drive used must be chosen according to motor current.

1. The motor is a so-called "Can motor" with a stainless steel can between the rotor and stator. There is a larger and a more magnetic resistant air-gap than on a normal motor hence a weaker field which results in the motors being designed with a higher rated current than a norm motor with similar rated power.
2. The pump contains thrust bearings which will be damaged when running below minimum speed which normally will be 30 Hz.
3. The motor reactance is nonlinear in submersible pump motors and therefore Automatic Motor Adaption (AMA) may not be possible. However, normally submersible pumps are operated with very long motor cables that might eliminate the nonlinear motor reactance and enable the drive to perform AMA. If AMA fails, the motor data can be set from parameter group 1-3* (see motor datasheet). Be aware that if AMA has succeeded the drive will compensate for voltage drop in the long motor cables, so if the Advanced motor data are set manually, the length of the motor cable must be taken into considerations to optimize system performance.
4. It is important that the system is operated with a minimum of wear and tear of the pump and motor. A Danfoss Sine-Wave filter can lower the motor insulation stress and increase lifetime (check actual motor insulation and the frequency converter du/dt specification). It is recommended to use a filter to reduce the need for service.
5. EMC performance can be difficult to achieve due to the fact that the special pump cable which is able to withstand the wet conditions in the well normally is unshielded. A solution could be to use a screened cable above the well and fix the screen to the well pipe if it is made of steel (can also be made of plastic). A Sine-Wave filter will also reduce the EMI from unshielded motor cables.

The special "can motor" is used due to the wet installation conditions. The drive needs to be designed for the system according to output current to be able to run the motor at nominal power.

To prevent damage to the thrust bearings of the pump, it is important to ramp the pump from stop to min. speed as quick as possible. Well-known manufacturers of submersible pumps recommend that the pump is ramped to min. speed (30 Hz) in max. 2 -3 seconds. The new VL^T AQUA Drive is designed with initial and final Ramp for these applications. The initial and final ramps are 2 individual ramps, where Initial Ramp, if enabled, will ramp the motor from stop to min. speed and automatically switch to normal ramp, when min. speed is reached. Final ramp will do the opposite from min. speed to stop in a stop situation.

Pipe-Fill mode can be enabled to prevent water hammering. The Danfoss frequency converter is capable of filling vertical pipes using the PID controller to slowly ramp up the pressure with a user specified rate (units/sec). If enabled the drive will, when it reaches min. speed after startup, enter pipe fill mode. The pressure will slowly be ramped up until it reaches a user specified Filled Set Point, where after the drive automatically disables Pipe Fill Mode and continues in normal closed loop operation.

This feature is designed for irrigation applications.

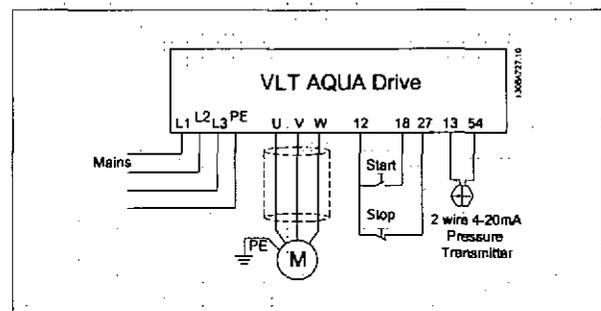
Electrical Wiring

Typical parameter settings (Typical/recommended settings in brackets.)

Parameters:	
Motor Rated Power	Par. 1-20 / par. 1-21
Motor Rated Voltage	Par. 1-22
Motor Current	Par. 1-24
Motor Rated Speed	Par. 1-28
Enable Reduced Automatic Motor Adaptation (AMA in par. 1-29)	

NB!

Note the analog input 2, (terminal (54) format must be set to mA. (switch 202).





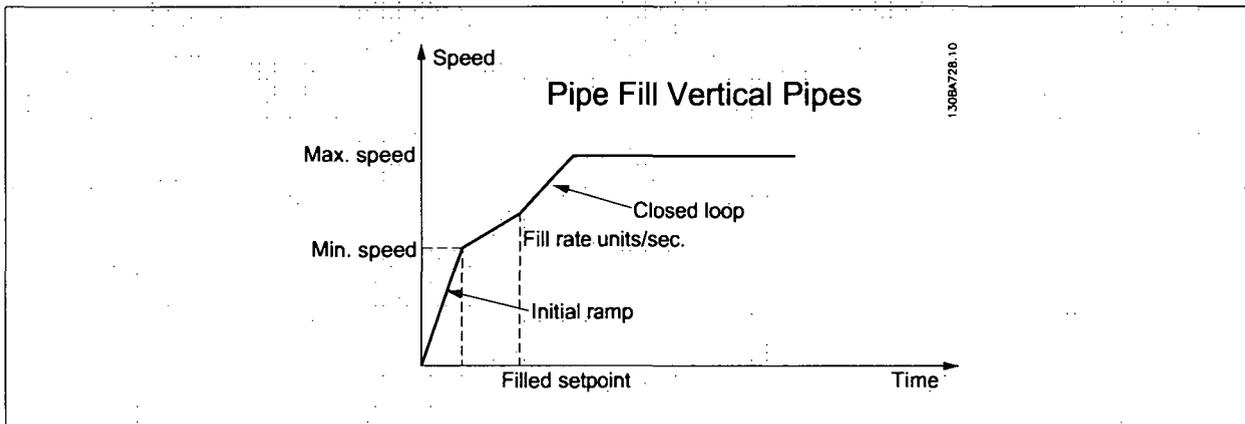
6 Commissioning and Application Examples

Min. Reference	Par. 3-01	(30 Hz)
Max. Reference	Par. 3-02	(50/60 Hz)
Initial Ramp Up Time	Par. 3-84	(2 sec.)
Final Ramp Down Time	Par. 3-88	(2 sec.)
Normal Ramp Up Time	Par. 3-41	(8 sec. depending on size)
Normal Ramp Down Time	Par. 3-42	(8 sec. depending on size)
Motor Min. Speed	Par. 4-11	(30 Hz)
Motor Max. Speed	Par. 4-13	(50/60 Hz)

Use the "Closed Loop" wizard under "Quick Menu_Funtion_Setup", to easily set up the feedback settings in the PID controller.

Pipe Fill Mode		
Pipe Fill Enable	Par. 29-00	
Pipe Fill Rate	Par. 29-04	(Feedback units/sec.)
Filled Set Point	Par. 29-05	(Feedback units)

6



7 How to Operate the Frequency Converter

7.1 Ways of Operation

7.1.1 Ways of operation

The frequency converter can be operated in 3 ways:

1. Graphical Local Control Panel (GLCP), see 6.1.2
2. Numeric Local Control Panel (NLCP), see 6.1.3
3. RS-485 serial communication or USB, both for PC connection, see 6.1.4

If the frequency converter is fitted with fieldbus option, please refer to relevant documentation.

7.1.2 How to operate graphical LCP (GLCP)

The following instructions are valid for the GLCP (LCP 102).

The GLCP is divided into four functional groups:

1. Graphical display with Status lines.
2. Menu keys and indicator lights (LED's) - selecting mode, changing parameters and switching between display functions.
3. Navigation keys and indicator lights (LEDs).
4. Operation keys and indicator lights (LEDs).

Graphical display:

The LCD-display is back-lit with a total of 6 alpha-numeric lines. All data is displayed on the LCP which can show up to five operating variables while in [Status] mode.

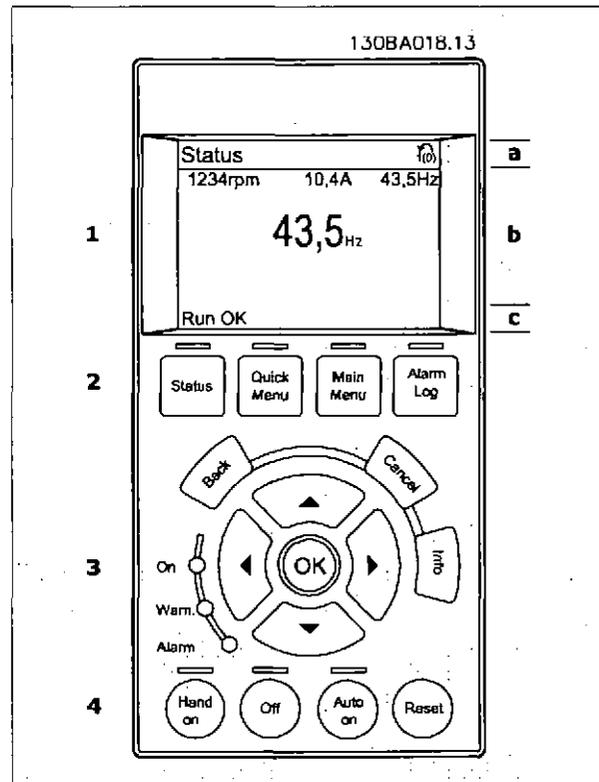
Display lines:

- a. **Status line:** Status messages displaying icons and graphics.
- b. **Line 1-2:** Operator data lines displaying data and variables defined or chosen by the user. By pressing the [Status] key, up to one extra line can be added.
- c. **Status line:** Status messages displaying text.

The display is divided into 3 sections:

Top section (a)

shows the status when in status mode or up to 2 variables when not in status mode and in the case of Alarm/Warning.



7 How to Operate the Frequency Converter

The number of the Active Set-up (selected as the Active Set-up in par. 0-10) is shown. When programming in another Set-up than the Active Set-up, the number of the Set-up being programmed appears to the right in brackets.

Middle section (b)

shows up to 5 variables with related unit, regardless of status. In case of alarm/warning, the warning is shown instead of the variables.

It is possible to toggle between three status read-out displays by pressing the [Status] key.

Operating variables with different formatting are shown in each status screen - see below.

Several values or measurements can be linked to each of the displayed operating variables. The values / measurements to be displayed can be defined via par. 0-20, 0-21; 0-22, 0-23, and 0-24, which can be accessed via [QUICK MENU], "Q3 Function Setups", "Q3-1 General Settings", "Q3-11 Display Settings".

Each value / measurement readout parameter selected in par. 0-20 to par. 0-24 has its own scale and number of digits after a possible decimal point. Larger numeric values are displayed with few digits after the decimal point.

Ex.: Current readout

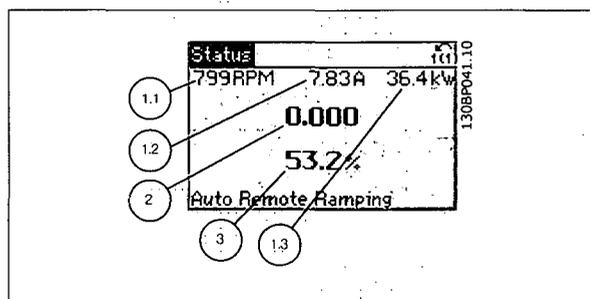
5.25 A; 15.2 A 105 A.

Status display I

This read-out state is standard after start-up or initialization.

Use [INFO] to obtain information about the value/measurement linked to the displayed operating variables (1.1, 1.2, 1.3, 2, and 3).

See the operating variables shown in the display in this illustration. 1.1, 1.2 and 1.3 are shown in small size. 2 and 3 are shown in medium size.

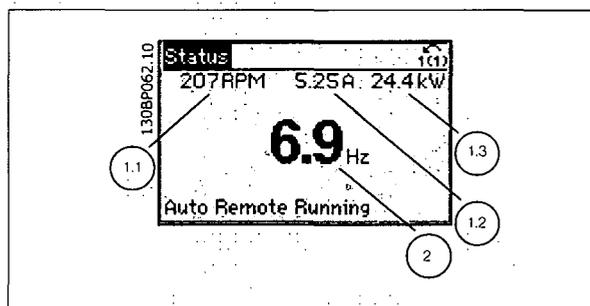


Status display II

See the operating variables (1.1, 1.2, 1.3, and 2) shown in the display in this illustration.

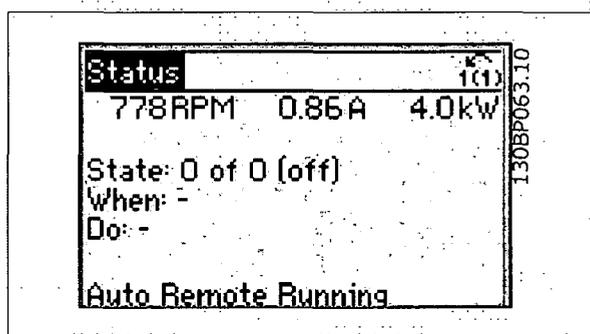
In the example, Speed, Motor current, Motor power and Frequency are selected as variables in the first and second lines.

1.1, 1.2 and 1.3 are shown in small size. 2 is shown in large size.



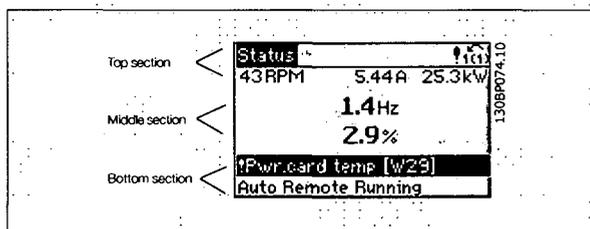
Status display III:

This state displays the event and action of the Smart Logic Control. For further information, see section *Smart Logic Control*.



Bottom section:

always shows the state of the frequency converter in Status mode.



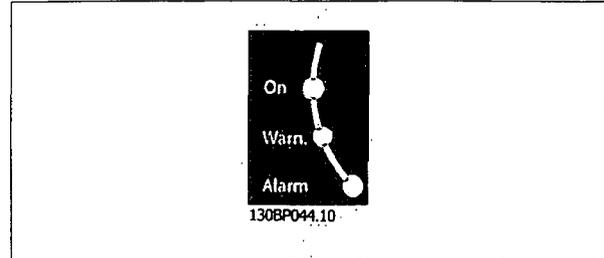
Display contrast adjustment

Press [status] and [▲] for darker display
Press [status] and [▼] for brighter display

Indicator lights (LEDs):

If certain threshold values are exceeded, the alarm and/or warning LED lights up. A status and alarm text appear on the control panel.
The On LED is activated when the frequency converter receives power from mains voltage, a DC bus terminal, or an external 24 V supply. At the same time, the back light is on.

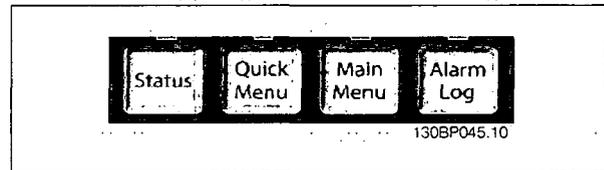
- Green LED/On: Control section is working.
- Yellow LED/Warn.: Indicates a warning.
- Flashing Red LED/Alarm: Indicates an alarm.



GLCP keys

Menu keys

The menu keys are divided into functions. The keys below the display and indicator lamps are used for parameter set-up, including choice of display indication during normal operation.



[Status]

Indicates the status of the frequency converter and/or the motor. 3 different readouts can be chosen by pressing the [Status] key:
5 line readouts, 4 line readouts or Smart Logic Control.

Use [Status] for selecting the mode of display or for changing back to Display mode from either the Quick Menu mode, the Main Menu mode or Alarm mode. Also use the [Status] key to toggle single or double read-out mode.

[Quick Menu]

Allows quick set-up of the frequency converter. **The most common functions can be programmed here.**

The [Quick Menu] consists of:

- **Q1: My Personal Menu**
- **Q2: Quick Setup**
- **Q3: Function Setups**
- **Q5: Changes Made**
- **Q6: Loggings**

The Function set-up provides quick and easy access to all parameters required for the majority of water and wastewater applications including variable torque, constant torque, pumps, dosing pumps, well pumps, booster pumps, mixer pumps, aeration blowers and other pump and fan applications. Amongst other features it also includes parameters for selecting which variables to display on the LCP, digital preset speeds, scaling of analog references, closed loop single zone and multi-zone applications and specific functions related to water and wastewater applications.

The Quick Menu parameters can be accessed immediately unless a password has been created via par. 0-60, 0-61, 0-65 or 0-66.

It is possible to switch directly between Quick Menu mode and Main Menu mode.

[Main Menu]

is used for programming all parameters.

The Main Menu parameters can be accessed immediately unless a password has been created via par. 0-60, 0-61, 0-65 or 0-66. For the majority of water and wastewater applications it is not necessary to access the Main Menu parameters but instead the Quick Menu, Quick Setup and Function Setups provides the simplest and quickest access to the typical required parameters.

It is possible to switch directly between Main Menu mode and Quick Menu mode.

Parameter shortcut can be carried out by pressing down the [Main Menu] key for 3 seconds. The parameter shortcut allows direct access to any parameter.

7 How to Operate the Frequency Converter

[Alarm Log]

displays an Alarm list of the five latest alarms (numbered A1-A5). To obtain additional details about an alarm, use the arrow keys to manoeuvre to the alarm number and press [OK]. Information is displayed about the condition of the frequency converter before it enters the alarm mode.

[Back]

reverts to the previous step or layer in the navigation structure.

[Cancel]

last change or command will be cancelled as long as the display has not been changed.

[Info]

displays information about a command, parameter, or function in any display window. [Info] provides detailed information when needed.

Exit Info mode by pressing either [Info], [Back], or [Cancel].



7

Navigation keys

The four navigation arrows are used to navigate between the different choices available in [Quick Menu], [Main Menu] and [Alarm Log]. Use the keys to move the cursor.

[OK]

is used for choosing a parameter marked by the cursor and for enabling the change of a parameter.



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Operation keys

for local control are found at the bottom of the control panel.



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[Hand on]

enables control of the frequency converter via the GLCP. [Hand on] also starts the motor, and it is now possible to give the motor speed reference by means of the arrow keys. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-40 [Hand on] Key on LCP.

The following control signals will still be active when [Hand on] is activated:

- [Hand on] - [Off] - [Auto on]
- Reset
- Coasting stop inverse (motor coasting to stop)
- Reversing
- Set-up select lsb - Set-up select msb
- Stop command from serial communication
- Quick stop
- DC brake



NB!
 External stop signals activated by means of control signals or a serial bus will override a "start" command via the LCP.

[Off]

stops the connected motor. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-41: [Off] key on LCP. If no external stop function is selected and the [Off] key is inactive the motor can only be stopped by disconnecting the mains supply.

[Auto on]

enables the frequency converter to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the frequency converter will start. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-42 [Auto on] key on LCP.

NB!
 An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand on] – [Auto on].

[Reset]

is used for resetting the frequency converter after an alarm (trip). The key can be *Enabled* [1] or *Disabled* [0] via par. 0-43 Reset Keys on LCP.

The parameter shortcut

can be carried out by holding down the [Main Menu] key for 3 seconds. The parameter shortcut allows direct access to any parameter.



7.1.3 How to operate numeric LCP (NLCP)

The following instructions are valid for the NLCP (LCP 101).

The control panel is divided into four functional groups:

1. Numeric display.
2. Menu key and indicator lights (LEDs) - changing parameters and switching between display functions.
3. Navigation keys and indicator lights (LEDs).
4. Operation keys and indicator lights (LEDs).

Select one of the following modes:

Status Mode: Displays the status of the frequency converter or the motor.

If an alarm occurs, the NLCP automatically switches to status mode. A number of alarms can be displayed.

Quick Setup or Main Menu Mode: Display parameters and parameter settings.

NB!
 Parameter copy is not possible with Numeric Local Control Panel (LCP101).

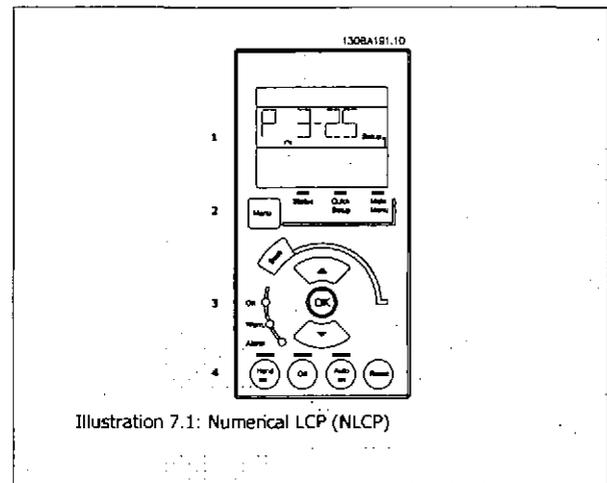


Illustration 7.1: Numerical LCP (NLCP)

7 How to Operate the Frequency Converter

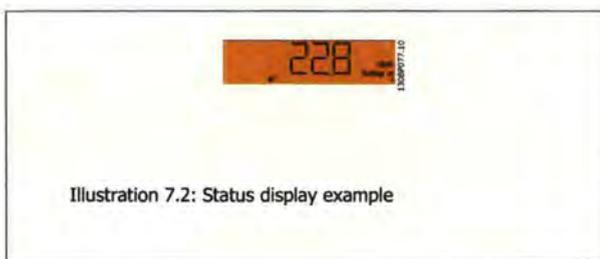


Illustration 7.2: Status display example

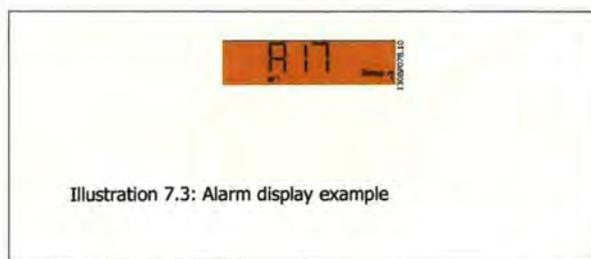


Illustration 7.3: Alarm display example

Indicator lights (LEDs):

- Green LED/On: Indicates if control section is on.
- Yellow LED/Wrn.: Indicates a warning.
- Flashing red LED/Alarm: Indicates an alarm.

Menu key

Select one of the following modes:

- Status
- Quick Setup
- Main Menu

Main Menu

is used for programming all parameters.

The parameters can be accessed immediately unless a password has been created via par. 0-60 *Main Menu Password*, par. 0-61 *Access to Main Menu w/o Password*, par. 0-65 *Personal Menu Password* or par. 0-66 *Access to Personal Menu w/o Password*.

Quick Setup is used to set up the frequency converter using only the most essential parameters.

The parameter values can be changed using the up/down arrows when the value is flashing.

Select Main Menu by pressing the [Menu] key a number of times until the Main Menu LED is lit.

Select the parameter group [xx-__] and press [OK]

Select the parameter [__-xx] and press [OK]

If the parameter is an array parameter select the array number and press [OK]

Select the wanted data value and press [OK]

Navigation keys**[Back]**

for stepping backwards

Arrow [▲] [▼]

keys are used for manoeuvring between parameter groups, parameters and within parameters

[OK]

is used for choosing a parameter marked by the cursor and for enabling the change of a parameter.

Operation keys

Keys for local control are found at the bottom of the control panel.



Illustration 7.4: Display example

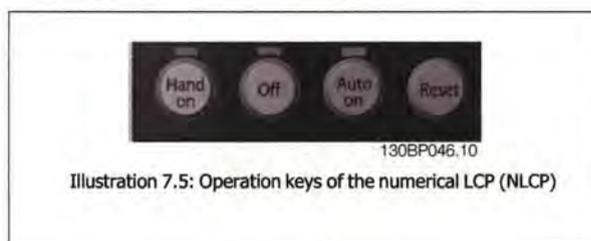


Illustration 7.5: Operation keys of the numerical LCP (NLCP)

[Hand on]

enables control of the frequency converter via the LCP. [Hand on] also starts the motor and it is now possible to enter the motor speed data by means of the arrow keys. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-40 *[Hand on] Key on LCP*.

External stop signals activated by means of control signals or a serial bus will override a 'start' command via the LCP.

The following control signals will still be active when [Hand on] is activated:

- [Hand on] - [Off] - [Auto on]
- Reset
- Coasting stop inverse
- Reversing
- Set-up select lsb - Set-up select msb
- Stop command from serial communication
- Quick stop
- DC brake

[Off]

stops the connected motor. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-41 *[Off] Key on LCP*.

If no external stop function is selected and the [Off] key is inactive the motor can be stopped by disconnecting the mains supply.

[Auto on]

enables the frequency converter to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the frequency converter will start. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-42 *[Auto on] Key on LCP*.

NB!

An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand on] [Auto on].



[Reset]

is used for resetting the frequency converter after an alarm (trip). The key can be *Enabled* [1] or *Disabled* [0] via par. 0-43 *[Reset] Key on LCP*.

7.1.4 Changing data

1. Press [Quick Menu] or [Main Menu] key.
2. Use [▲] and [▼] keys to find parameter group to edit.
3. Press [OK] key.
4. Use [▲] and [▼] keys to find parameter to edit.
5. Press [OK] key.
6. Use [▲] and [▼] keys to select correct parameter setting. Or, to move to digits within a number, use keys. Cursor indicates digit selected to change. [▲] key increases the value, [▼] key decreases the value.
7. Press [Cancel] key to disregard change, or press [OK] key to accept change and enter new setting.

7 How to Operate the Frequency Converter

7.1.5 Changing a text value

If the selected parameter is a text value, change the text value by means of the up/down navigation keys.

The up key increases the value, and the down key decreases the value.

Place the cursor on the value to be saved and press [OK].

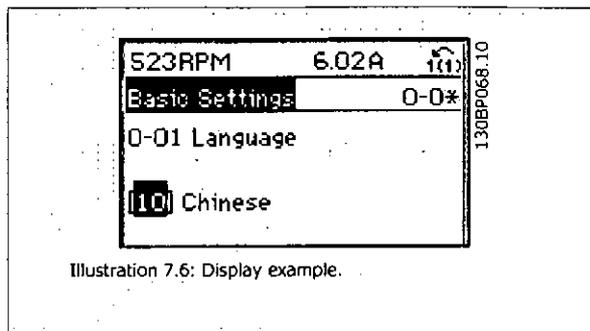


Illustration 7.6: Display example.

7.1.6 Changing a group of numeric data values

If the chosen parameter represents a numeric data value, change the chosen data value by means of the [-] and [+] navigation keys as well as the up/down [▲] [▼] navigation keys. Use the [-] and [+] navigation keys to move the cursor horizontally.

7

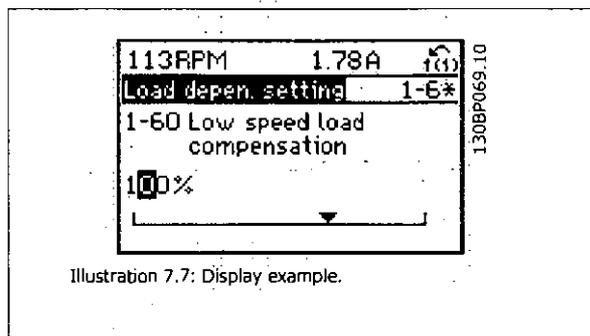


Illustration 7.7: Display example.

Use the up/down navigation keys to change the data value. The up key enlarges the data value, and the down key reduces the data value. Place the cursor on the value to be saved and press [OK].

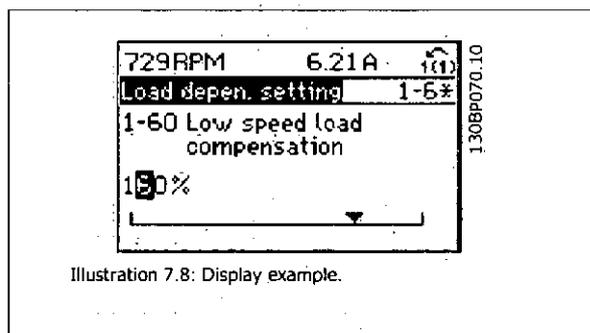


Illustration 7.8: Display example.

7.1.7 Changing of data value, Step-by-Step

Certain parameters can be changed step by step or infinitely variably. This applies to par. 1-20 *Motor Power [kW]*, par. 1-22 *Motor Voltage* and par. 1-23 *Motor Frequency*.

The parameters are changed both as a group of numeric data values and as numeric data values infinitely variably.

7.1.8 Read-out and programming of indexed parameters

Parameters are indexed when placed in a rolling stack.

Par. 15-30 *Alarm Log: Error Code* to par. 15-32 *Alarm Log: Time* contain a fault log which can be read out. Choose a parameter, press [OK], and use the up/down navigation keys to scroll through the value log.

Use par. 3-10 *Preset Reference* as another example:

Choose the parameter, press [OK], and use the up/down navigation keys to scroll through the indexed values. To change the parameter value, select the indexed value and press [OK]. Change the value by using the up/down keys. Press [OK] to accept the new setting. Press [Cancel] to abort. Press [Back] to leave the parameter.

7.1.9 Tips and tricks

*	For the majority of water and wastewater applications the Quick Menu, Quick Setup and Function Setups provides the simplest and quickest access to all the typical parameters required.
*	Whenever possible, performing an AMA, will ensure best shaft performance
*	Contrast of the display can be adjusted by pressing [Status] and [▲] for darker display or by pressing [Status] and [▼] for brighter display
*	Under [Quick Menu] and [Changes Made] all parameters that have been changed from factory settings are displayed
*	Press and hold [Main Menu] key for 3 seconds for access to any parameter
*	For service purposes it is recommended to copy all parameters to the LCP, see par 0-50 for further information

Table 7.1: Tips and tricks

7.1.10 Quick transfer of parameter settings when using GLCP

Once the set-up of a frequency converter is complete, it is recommended to store (backup) the parameter settings in the GLCP or on a PC via MCT 10 Set-up Software Tool.



NB!
Stop the motor before performing any of these operations.

Data storage in LCP:

1. Go to par. 0-50 *LCP Copy*
2. Press the [OK] key
3. Select "All to LCP"
4. Press the [OK] key

All parameter settings are now stored in the GLCP indicated by the progress bar. When 100% is reached, press [OK].

The GLCP can now be connected to another frequency converter and the parameter settings copied to this frequency converter.

Data transfer from LCP to Frequency converter:

1. Go to par. 0-50 *LCP Copy*
2. Press the [OK] key
3. Select "All from LCP"
4. Press the [OK] key

The parameter settings stored in the GLCP are now transferred to the frequency converter indicated by the progress bar. When 100% is reached, press [OK].

7.1.11 Initialisation to default settings

There are two ways to initialise the frequency converter to default: Recommended initialisation and manual initialisation. Please be aware that they have different impact according to the below description.

Recommended initialisation (via par. 14-22 *Operation Mode*)

1. Select par. 14-22 *Operation Mode*
2. Press [OK]
3. Select "Initialisation" (for NLCP select "2")
4. Press [OK]

5. Remove power to unit and wait for display to turn off.
6. Reconnect power and the frequency converter is reset. Note that first start-up takes a few more seconds
7. Press [Reset]



7 How to Operate the Frequency Converter

par. 14-22 *Operation Mode* initialises all except:

par. 14-50 *RFI Filter*

par. 8-30 *Protocol*

par. 8-31 *Address*

par. 8-32 *Baud Rate*

par. 8-35 *Minimum Response Delay*

par. 8-36 *Max Response Delay*

par. 8-37 *Maximum Inter-Char Delay*

par. 15-00 *Operating Hours* to par. 15-05 *Over Volt's*

par. 15-20 *Historic Log: Event* to par. 15-22 *Historic Log: Time*

par. 15-30 *Alarm Log: Error Code* to par. 15-32 *Alarm Log: Time*



NB!

Parameters selected in par. 0-25 *My Personal Menu*, will stay present, with default factory setting.

Manual initialisation

7



NB!

When carrying out manual initialisation, serial communication, RFI filter settings and fault log settings are reset.

Removes parameters selected in par. 0-25 *My Personal Menu*

1. Disconnect from mains and wait until the display turns off.
- 2a. Press [Status] - [Main Menu] - [OK] at the same time while power up for Graphical LCP (GLCP)
- 2b. Press [Menu] while power up for LCP 101, Numerical Display
3. Release the keys after 5 s
4. The frequency converter is now programmed according to default settings

This parameter initialises all except:

par. 15-00 *Operating Hours*

par. 15-03 *Power Up's*

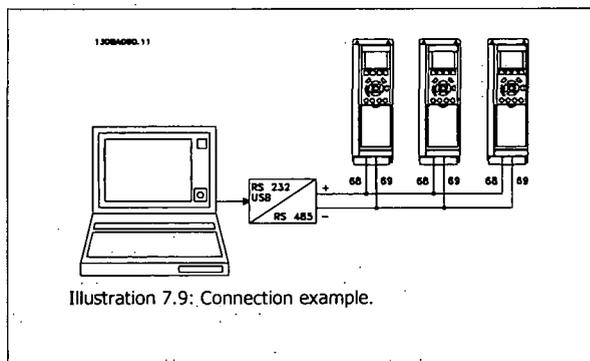
par. 15-04 *Over Temp's*

par. 15-05 *Over Volt's*

7.1.12 RS-485 bus connection

One or more frequency converters can be connected to a controller (or master) using the RS-485 standard interface. Terminal 68 is connected to the P signal (TX+, RX+), while terminal 69 is connected to the N signal (TX-,RX-).

If more than one frequency converter is connected to a master, use parallel connections.



In order to avoid potential equalizing currents in the screen, earth the cable screen via terminal 61, which is connected to the frame via an RC-link.

Bus termination

The RS-485 bus must be terminated by a resistor network at both ends. If the drive is the first or the last device in the RS-485 loop, set the switch S801 on the control card for ON.

For more information, see the paragraph *Switches S201, S202, and S801*.

7.1.13 How to connect a PC to the frequency converter

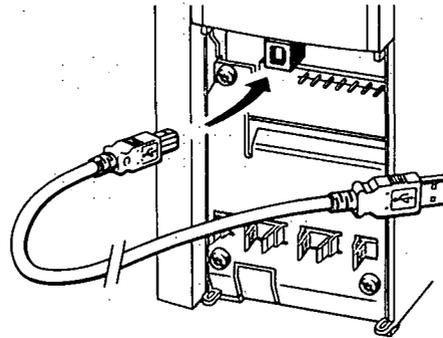
To control or program the frequency converter from a PC, install the PC-based Configuration Tool MCT 10.

The PC is connected via a standard (host/device) USB cable, or via the RS-485 interface as shown in the *Design Guide, chapter How to Install > Installation of misc. connections.*



NB!

The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. The USB connection is connected to protection earth on the frequency converter. Use only isolated laptop as PC connection to the USB connector on the frequency converter.



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Illustration 7.10: For control cable connections, see section on *Control Terminals.*

7.1.14 PC software tools

PC-based Configuration Tool MCT 10

All Frequency converters are equipped with a serial communication port. Danfoss provides a PC tool for communication between PC and frequency converter, PC-based Configuration Tool MCT 10. Please check the section on *Available Literature* for detailed information on this tool.

MCT 10 set-up software

MCT 10 has been designed as an easy to use interactive tool for setting parameters in our frequency converters. The software can be downloaded from the Danfoss internet site <http://www.Danfoss.com/BusinessAreas/DrivesSolutions/SoftwareDownload/DDPC+Software+Program.htm>.

The MCT 10 set-up software will be useful for:

- Planning a communication network off-line. MCT 10 contains a complete frequency converter database
- Commissioning frequency converters on line
- Saving settings for all frequency converters
- Replacing a frequency converter in a network
- Simple and accurate documentation of frequency converter settings after commissioning.
- Expanding an existing network
- Future developed frequency converters will be supported.

MCT 10 set-up software supports Profibus DP-V1 via a Master class 2 connection. It makes it possible to on line read/write parameters in a frequency converter via the Profibus network. This will eliminate the need for an extra communication network.

7 How to Operate the Frequency Converter

**Save frequency converter settings:**

1. Connect a PC to the unit via USB com port. (Note: Use a PC, which is isolated from the mains, in conjunction with the USB port. Failure to do so may damage equipment.)
2. Open MCT 10 Set-up Software
3. Choose "Read from drive"
4. Choose "Save as"

All parameters are now stored in the PC.

Load frequency converter settings:

1. Connect a PC to the frequency converter via USB com port
2. Open MCT 10 Set-up software
3. Choose "Open"-- stored files will be shown
4. Open the appropriate file
5. Choose "Write to drive"

All parameter settings are now transferred to the frequency converter.

A separate manual for MCT 10 Set-up Software is available: *MG.10.Rx.yy*.

7

The MCT 10 Set-up software modules

The following modules are included in the software package:

	MCT Set-up 10 Software Setting parameters Copy to and from frequency converters Documentation and print out of parameter settings incl. diagrams
	<hr/> Ext. user interface Preventive Maintenance Schedule Clock settings Timed Action Programming Smart Logic Controller Set-up

Ordering number:

Please order the CD containing MCT 10 Set-up Software using code number 130B1000.

MCT 10 can also be downloaded from the Danfoss Internet: WWW.DANFOSS.COM, Business Area: Motion Controls.



8 How to Programme the Frequency Converter

8.1 How to Programme

8.1.1 Parameter set-up

Overview of parameter groups

Group	Title	Function
0-	Operation / Display	Parameters related to the fundamental functions of the frequency converter, function of the LCP buttons and configuration of the LCP display.
1-	Load / Motor	Parameter group for motor settings.
2-	Brakes	Parameter group for setting brake features in the frequency converter.
3-	Reference / Ramps	Parameters for reference handling, definitions of limitations, and configuration of the reaction of the frequency converter to changes.
4-	Limits / Warnings	Parameter group for configuring limits and warnings.
5-	Digital In/Out	Parameter group for configuring the digital inputs and outputs.
6-	Analog In/Out	Parameter group for configuration of the analog inputs and outputs.
8-	Communication and Options	Parameter group for configuring communications and options.
9-	Profibus	Parameter group for Profibus-specific parameters.
10-	DeviceNet Fieldbus	Parameter group for DeviceNet-specific parameters.
13-	Smart Logic	Parameter group for Smart Logic Control
14-	Special Functions	Parameter group for configuring special frequency converter functions.
15-	Drive Information	Parameter group containing frequency converter information such as operating data, hardware configuration and software versions.
16-	Data Readouts	Parameter group for data read-outs, e.g. actual references, voltages, control, alarm, warning and status words.
18-	Info and Readouts	This parameter group contains the last 10 Preventive Maintenance logs.
20-	Drive Closed Loop	This parameter group is used for configuring the closed loop PID Controller that controls the output frequency of the unit.
21-	Extended Closed Loop	Parameters for configuring the three Extended Closed Loop PID Controllers.
22-	Application Functions	These parameters monitor water applications.
23-	Time-based Functions	These parameters are for actions needed to be performed on a daily or weekly basis, e.g. different references for working hours/non-working hours.
25-	Basic Cascade Controller Functions	Parameters for configuring the Basic Cascade Controller for sequence control of multiple pumps.
26-	Analog I/O Option MCB 109	Parameters for configuring the Analog I/O Option MCB 109.
27-	Extended Cascade Control	Parameters for configuring the Extended Cascade Control.
29-	Water Application Functions	Parameters for setting water specific functions.
31-	Bypass Option	Parameters for configuring the Bypass Option

Table 8.1: Parameter groups

Parameter descriptions and selections are displayed on the graphic (GLCP) or numeric (NLCP) in the display area. (See Section 5 for details.) Access the parameters by pressing the [Quick Menu] or [Main Menu] key on the control panel. The quick menu is used primarily for commissioning the unit at start-up by providing those parameters necessary to start operation. The main menu provides access to all parameters for detailed application programming.

All digital input/output and analog input/output terminals are multifunctional. All terminals have factory default functions suitable for the majority of water applications but if other special functions are required, they must be programmed in parameter group 5 or 6.

8.1.2 Q1 My Personal Menu

Parameters defined by the user can be stored in Q1 My Personal Menu.

Select *My Personal Menu* to display only the parameters, which have been pre-selected and programmed as personal parameters. For example, a pump or equipment OEM may have pre-programmed these to be in My Personal Menu during factory commissioning to make on site commissioning / fine tuning simpler. These parameters are selected in par. 0-25 *My Personal Menu*. Up to 20 different parameters can be defined in this menu.

Q1 My Personal Menu
20-21 Setpoint 1
20-93 PID Proportional Gain
20-94 PID Integral Time



8 How to Programme the Frequency Converter



8.1.3 Q2 Quick Setup

The parameters in Q2 Quick Setup are the basic parameters, which are always needed to set-up the frequency converter to operation.

Q2 Quick Setup	
Parameter number and name	Unit
0-01 Language	
1-20 Motor Power	KW
1-22 Motor Voltage	V
1-23 Motor Frequency	Hz
1-24 Motor Current	A
1-25 Motor Nominal Speed	RPM
3-41 Ramp 1 Ramp Up Time	s
3-42 Ramp 1 Ramp Down Time	s
4-11 Motor Speed Low Limit	RPM
4-13 Motor Speed High Limit	RPM
1-29 Automatic Motor Adaptation (AMA)	

8.1.4 Q3 Function Setups

The Function Setup provides quick and easy access to all parameters required for the majority of water and wastewater applications including variable torque, constant torque, pumps, dosing pumps, well pumps, booster pumps, mixer pumps, aeration blowers and other pump and fan applications. Amongst other features it also includes parameters for selecting which variables to display on the LCP, digital preset speeds, scaling of analog references, closed loop single zone and multi-zone applications and specific functions related to water and wastewater applications.

How to access Function Set-up - example:

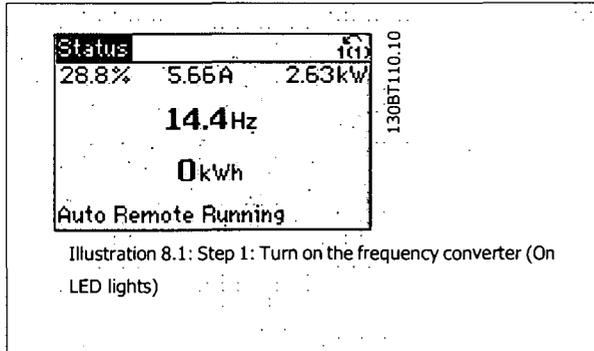


Illustration 8.1: Step 1: Turn on the frequency converter (On LED lights)

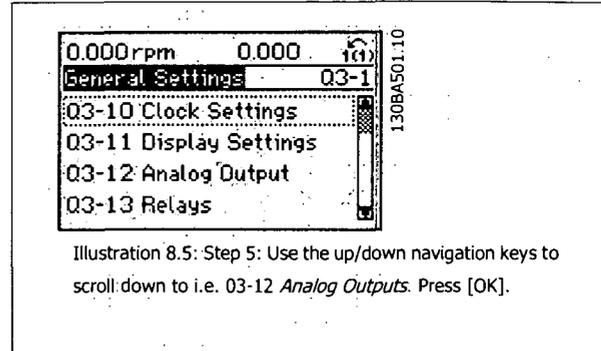


Illustration 8.5: Step 5: Use the up/down navigation keys to scroll down to i.e. 03-12 Analog Outputs. Press [OK].

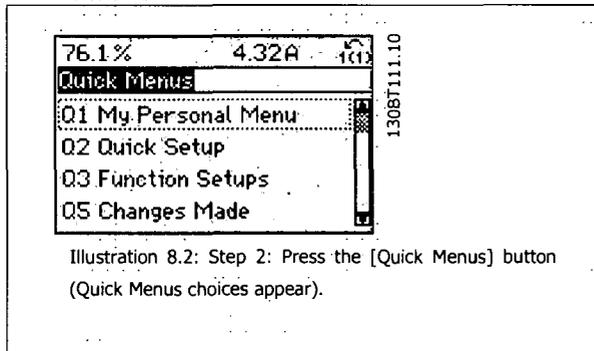


Illustration 8.2: Step 2: Press the [Quick Menu] button (Quick Menu choices appear).

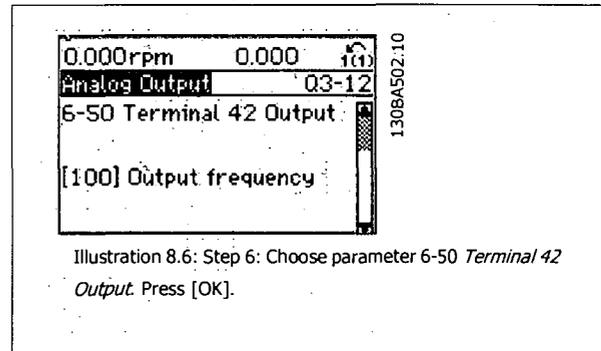


Illustration 8.6: Step 6: Choose parameter 6-50 Terminal 42 Output. Press [OK].

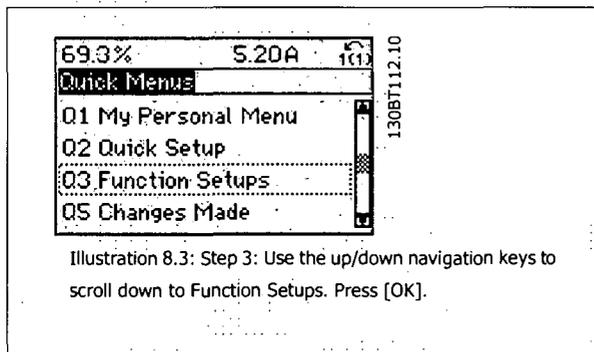


Illustration 8.3: Step 3: Use the up/down navigation keys to scroll down to Function Setups. Press [OK].

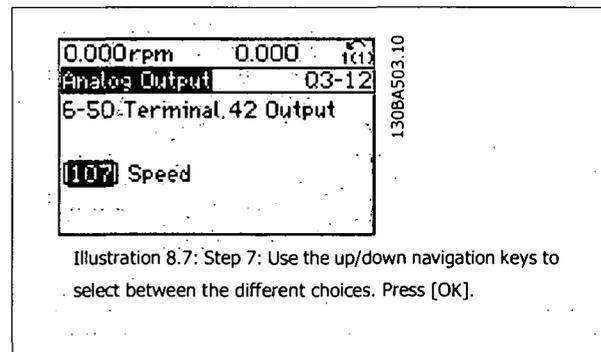


Illustration 8.7: Step 7: Use the up/down navigation keys to select between the different choices. Press [OK].

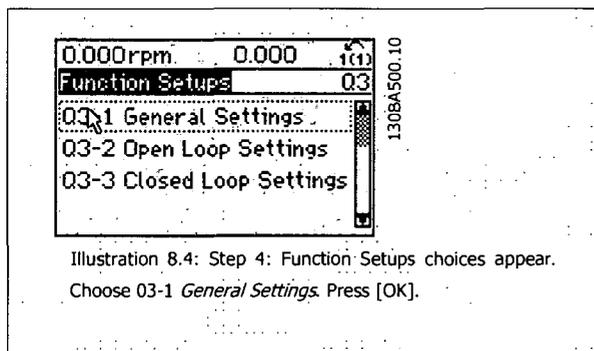


Illustration 8.4: Step 4: Function Setups choices appear. Choose 03-1 General Settings. Press [OK].

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The Function Setup parameters are grouped in the following way:

Q3-1 General Settings			
Q3-10 Clock Settings	Q3-11 Display Settings	Q3-12 Analog Output	Q3-13 Relays
0-70 Set Date and Time	0-20 Display Line 1.1 Small	6-50 Terminal 42 Output	Relay 1 ⇒ 5-40 Function Relay
0-71 Date Format	0-21 Display Line 1.2 Small	6-51 Terminal 42 Output Min Scale	Relay 2 ⇒ 5-40 Function Relay
0-72 Time Format	0-22 Display Line 1.3 Small	6-52 Terminal 42 Output Max Scale	Option relay 7 ⇒ 5-40 Function Relay
0-74 DST/Summertime	0-23 Display Line 2 Large		Option relay 8 ⇒ 5-40 Function Relay
0-76 DST/Summertime Start	0-24 Display Line 3 Large		Option relay 9 ⇒ 5-40 Function Relay
0-77 DST/Summertime End	0-37 Display Text 1		
	0-38 Display Text 2		
	0-39 Display Text 3		

Q3-2 Open Loop Settings	
Q3-20 Digital Reference	Q3-21 Analog Reference
3-02 Minimum Reference	3-02 Minimum Reference
3-03 Maximum Reference	3-03 Maximum Reference
3-10 Preset Reference	6-10 Terminal 53 Low Voltage
5-13 Terminal 29 Digital Input	6-11 Terminal 53 High Voltage
5-14 Terminal 32 Digital Input	6-14 Terminal 53 Low Ref/Feedb. Value
5-15 Terminal 33 Digital Input	6-15 Terminal 53 High Ref/Feedb. Value

Q3-3 Closed Loop Settings	
Q3-30 Feedback Settings	Q3-31 PID Settings
1-00 Configuration Mode	20-81 PID Normal/Inverse Control
20-12 Reference/Feedb.Unit	20-82 PID Start Speed [RPM]
3-02 Minimum Reference	20-21 Setpoint 1
3-03 Maximum Reference	20-93 PID Proportional Gain
6-20 Terminal 54 Low Voltage	20-94 PID Integral Time
6-21 Terminal 54 High Voltage	
6-24 Terminal 54 Low Ref/Feedb Value	
6-25 Terminal 54 High Ref/Feedb Value	
6-00 Live Zero Timeout Time	
6-01 Live Zero Timeout Function	

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8.1.5 Q5 Changes Made

Q5 Changes Made can be used for fault finding.

Select **Changes made** to get information about:

- the last 10 changes. Use the up/down navigation keys to scroll between the last 10 changed parameters.
- the changes made since default setting.

Select **Loggings** to get information about the display line read-outs. The information is shown as graphs.

Only display parameters selected in par. 0-20 and par. 0-24 can be viewed. It is possible to store up to 120 samples in the memory for later reference.

Please notice that the parameters listed in the below tables for Q5 only serve as examples as they will vary depending on the programming of the particular frequency converter.

Q5-1 Last 10 Changes
20-94 PID Integral Time
20-93 PID Proportional Gain

Q5-2 Since Factory Setting
20-93 PID Proportional Gain
20-94 PID Integral Time

Q5-3 Input Assignments
Analog Input 53
Analog Input 54

8.1.6 Q6 Loggings

Q6 Loggings can be used for fault finding.

Please notice that the parameters listed in the below table for Q6 only serve as examples as they will vary depending on the programming of the particular frequency converter.

Q6 Loggings	
Reference	
Analog Input 53	
Motor Current	
Frequency	
Feedback	
Energy Log	
Trending Cont Bin	
Trending Timed Bin	
Trending Comparison	

8.1.7 Main Menu mode

Both the GLCP and NLCP provide access to the main menu mode. Select the Main Menu mode by pressing the [Main Menu] key. Illustration 6.2 shows the resulting read-out, which appears on the display of the GLCP. Lines 2 through 5 on the display show a list of parameter groups which can be chosen by toggling the up and down buttons.

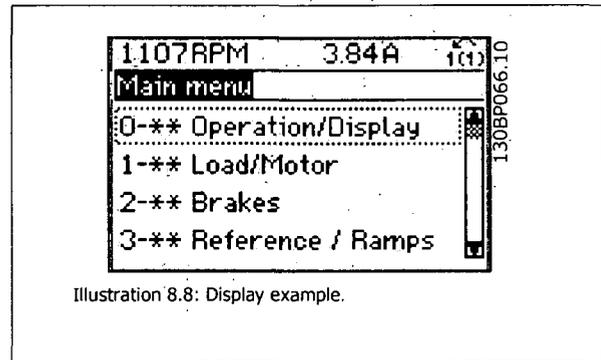


Illustration 8.8: Display example.

Each parameter has a name and number which remain the same regardless of the programming mode. In the Main Menu mode, the parameters are divided into groups. The first digit of the parameter number (from the left) indicates the parameter group number.

All parameters can be changed in the Main Menu. The configuration of the unit (par. 1-00 *Configuration Mode*) will determine other parameters available for programming. For example, selecting Closed Loop enables additional parameters related to closed loop operation. Option cards added to the unit enable additional parameters associated with the option device.

8.1.8 Parameter selection

In the Main Menu mode, the parameters are divided into groups. Select a parameter group by means of the navigation keys.

The following parameter groups are accessible:

8 How to Programme the Frequency Converter



Group no.	Parameter group:
0	Operation/Display
1	Load/Motor
2	Brakes
3	References/Ramps
4	Limits/Warnings
5	Digital In/Out
6	Analog In/Out
8	Comm. and Options
9	Profibus
10	CAN Fieldbus
11	LonWorks
13	Smart Logic
14	Special Functions
15	Drive Information
16	Data Readouts
18	Data Readouts 2
20	Drive Closed Loop
21	Ext. Closed Loop
22	Application Functions
23	Time-based Functions
24	Fire Mode
25	Cascade Controller
26	Analog I/O Option MCB 109

Table 8.2: Parameter groups.

After selecting a parameter group, choose a parameter by means of the navigation keys:

The middle section on the GLCP display shows the parameter number and name as well as the selected parameter value.

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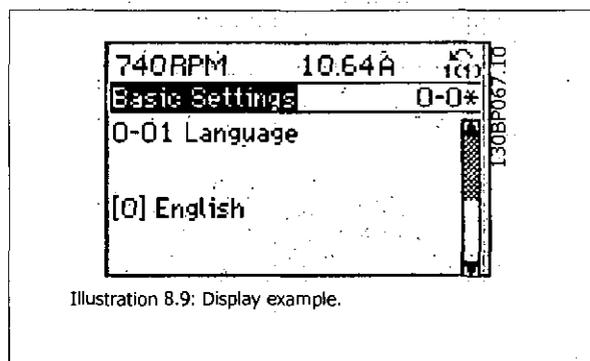


Illustration 8.9: Display example.

8.2 Commonly Used Parameters - Explanations

8.2.1 Main Menu

The Main Menu includes all available parameters in the VLT® AQUA Drive FC 200 frequency converter.

All parameters are grouped in a logic way with a group name indicating the function of the parameter group.

All parameters are listed by name and number in the section *Parameter Options* in these Operating Instructions.

All parameters included in the Quick Menus (Q1, Q2, Q3, Q5 and Q6) can be found in the following.

Some of the most used parameters for VLT® AQUA Drive applications are also explained in the following section.

For a detailed explanation of all parameters, please refer to the VLT® AQUA Drive Programming Guide MG.20.OX.YY which is available on www.danfoss.com or by ordering at the local Danfoss office.

8.2.2 0-** Operation / Display

Parameters related to the fundamental functions of the frequency converter, function of the LCP buttons and configuration of the LCP display.

0-01 Language

Option:

Function:

Defines the language to be used in the display.

The frequency converter can be delivered with 4 different language packages. English and German are included in all packages. English cannot be erased or manipulated.

[0] *	English	Part of Language packages 1 - 4
[1]	German	Part of Language packages 1 - 4
[2]	French	Part of Language package 1
[3]	Danish	Part of Language package 1
[4]	Spanish	Part of Language package 1
[5]	Italian	Part of Language package 1
[6]	Swedish	Part of Language package 1
[7]	Dutch	Part of Language package 1
[10]	Chinese	Language package 2
[20]	Finnish	Part of Language package 1
[22]	English US	Part of Language package 4
[27]	Greek	Part of Language package 4
[28]	Portuguese	Part of Language package 4
[36]	Slovenian	Part of Language package 3
[39]	Korean	Part of Language package 2
[40]	Japanese	Part of Language package 2
[41]	Turkish	Part of Language package 4
[42]	Traditional Chinese	Part of Language package 2
[43]	Bulgarian	Part of Language package 3
[44]	Serbian	Part of Language package 3
[45]	Romanian	Part of Language package 3
[46]	Hungarian	Part of Language package 3
[47]	Czech	Part of Language package 3
[48]	Polish	Part of Language package 4
[49]	Russian	Part of Language package 3
[50]	Thai	Part of Language package 2
[51]	Bahasa Indonesian	Part of Language package 2

0-20 Display Line 1,1 Small

Option:

Function:

Select a variable for display in line 1, left position.

[0]	None	No display value selected
[37]	Display Text 1	Present control word
[38]	Display Text 2	Enables an individual text string to be written, for display in the LCP or to be read via serial communication.
[39]	Display Text 3	Enables an individual text string to be written, for display in the LCP or to be read via serial communication.
[89]	Date and Time Readout	Displays the current date and time.
[953]	Profibus Warning Word	Displays Profibus communication warnings.
[1005]	Readout: Transmit Error Counter	View the number of CAN control transmission errors since the last power-up.

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[1006]	Readout Receive Error Counter	View the number of CAN control receipt errors since the last power-up.
[1007]	Readout Bus Off Counter	View the number of Bus Off events since the last power-up.
[1013]	Warning Parameter	View a DeviceNet-specific warning word. One separate bit is assigned to every warning.
[1115]	LON Warning Word	Shows the LON-specific warnings.
[1117]	XIF Revision	Shows the version of the external interface file of the Neuron C chip on the LON option.
[1118]	LON Works Revision	Shows the software version of the application program of the Neuron C chip on the LON option.
[1500]	Operating Hours	View the number of running hours of the frequency converter.
[1501]	Running Hours	View the number of running hours of the motor.
[1502]	kWh Counter	View the mains power consumption in kWh.
[1600]	Control Word	View the Control Word sent from the frequency converter via the serial communication port in hex code.
[1601] *	Reference [Unit]	Total reference (sum of digital/analog/preset/bus/freeze ref./catch up and slow-down) in selected unit.
[1602]	Reference %	Total reference (sum of digital/analog/preset/bus/freeze ref./catch up and slow-down) in percent.
[1603]	Status Word	Present status word
[1605]	Main Actual Value [%]	One or more warnings in a Hex code
[1609]	Custom Readout	View the user-defined readouts as defined in par. 0-30, 0-31 and 0-32.
[1610]	Power [kW]	Actual power consumed by the motor in kW.
[1611]	Power [hp]	Actual power consumed by the motor in HP.
[1612]	Motor Voltage	Voltage supplied to the motor.
[1613]	Motor Frequency	Motor frequency, i.e. the output frequency from the frequency converter in Hz.
[1614]	Motor Current	Phase current of the motor measured as effective value.
[1615]	Frequency [%]	Motor frequency, i.e. the output frequency from the frequency converter in percent.
[1616]	Torque [Nm]	Present motor load as a percentage of the rated motor torque.
[1617]	Speed [RPM]	Speed in RPM (revolutions per minute) i.e. the motor shaft speed in closed loop based on the entered motor nameplate data, the output frequency and the load on the frequency converter.
[1618]	Motor Thermal	Thermal load on the motor, calculated by the ETR function. See also parameter group 1-9* Motor Temperature.
[1622]	Torque [%]	Shows the actual torque produced, in percentage.
[1630]	DC Link Voltage	Intermediate circuit voltage in the frequency converter.
[1632]	BrakeEnergy/s	Present brake power transferred to an external brake resistor. Stated as an instantaneous value.
[1633]	BrakeEnergy/2 min	Brake power transferred to an external brake resistor. The mean power is calculated continuously for the most recent 120 seconds.
[1634]	Heatsink Temp.	Present heat sink temperature of the frequency converter. The cut-out limit is 95 ±5 °C; cutting back in occurs at 70 ±5° C.
[1635]	Thermal Drive Load	Percentage load of the inverters
[1636]	Inv. Nom. Current	Nominal current of the frequency converter
[1637]	Inv. Max. Current	Maximum current of the frequency converter
[1638]	SL Control State	State of the event executed by the control
[1639]	Control Card Temp.	Temperature of the control card.
[1650]	External Reference	Sum of the external reference as a percentage, i.e. the sum of analog/pulse/bus.
[1652]	Feedback [Unit]	Signal value in units from the programmed digital input(s).
[1653]	Digi Pot Reference	View the contribution of the digital potentiometer to the actual reference Feedback.
[1654]	Feedback 1 [Unit]	View the value of Feedback 1. See also par. 20-0*.
[1655]	Feedback 2 [Unit]	View the value of Feedback 2. See also par. 20-0*.
[1656]	Feedback 3 [Unit]	View the value of Feedback 3. See also par. 20-0*.
[1658]	PID Output [%]	Returns the Drive Closed Loop PID controller output value in percent.



[1659]	Adjusted Setpoint.	Displays the actual operating set-point after it is modified by flow compensation. See parameters 22-8*.
[1660]	Digital Input	Displays the status of the digital inputs. Signal low = 0; Signal high = 1. Regarding order, see par. 16-60. Bit 0 is at the extreme right.
[1661]	Terminal 53 Switch Setting	Setting of input terminal 53. Current = 0; Voltage = 1.
[1662]	Analog Input 53	Actual value at input 53 either as a reference or protection value.
[1663]	Terminal 54 Switch Setting	Setting of input terminal 54. Current = 0; Voltage = 1.
[1664]	Analog Input 54	Actual value at input 54 either as reference or protection value.
[1665]	Analog Output 42 [mA]	Actual value at output 42 in mA. Use par. 6-50 to select the variable to be represented by output 42.
[1666]	Digital Output [bin]	Binary value of all digital outputs.
[1667]	Freq. Input #29 [Hz]	Actual value of the frequency applied at terminal 29 as a pulse input.
[1668]	Freq. Input #33 [Hz]	Actual value of the frequency applied at terminal 33 as a pulse input.
[1669]	Pulse Output #27 [Hz]	Actual value of pulses applied to terminal 27 in digital output mode.
[1670]	Pulse Output #29 [Hz]	Actual value of pulses applied to terminal 29 in digital output mode.
[1671]	Rélay Output [bin]	View the setting of all relays.
[1672]	Counter A	View the present value of Counter A.
[1673]	Counter B	View the present value of Counter B.
[1675]	Analog input X30/11	Actual value of the signal on input X30/11 (General Purpose I/O Card. Option)
[1676]	Analog input X30/12	Actual value of the signal on input X30/12 (General Purpose I/O Card. Optional)
[1677]	Analog output X30/8 [mA]	Actual value at output X30/8 (General Purpose I/O Card. Optional) Use Par. 6-60 to select the variable to be shown.
[1680]	Fieldbus CTW 1	Control word (CTW) received from the Bus Master.
[1682]	Fieldbus REF 1	Main reference value sent with control word via the serial communications network e.g. from the BMS, PLC or other master controller.
[1684]	Comm. Option STW	Extended fieldbus communication option status word.
[1685]	FC Port CTW 1	Control word (CTW) received from the Bus Master.
[1686]	FC Port REF 1	Status word (STW) sent to the Bus Master.
[1690]	Alarm Word	One or more alarms in a Hex code (used for serial communications)
[1691]	Alarm Word 2	One or more alarms in a Hex code (used for serial communications)
[1692]	Warning Word	One or more warnings in a Hex code (used for serial communications)
[1693]	Warning Word 2	One or more warnings in a Hex code (used for serial communications)
[1694]	Ext. Status Word	One or more status conditions in a Hex code (used for serial communications)
[1695]	Ext. Status Word 2	One or more status conditions in a Hex code (used for serial communications)
[1696]	Maintenance Word	The bits reflect the status for the programmed Preventive Maintenance Events in parameter group 23-1*
[1830]	Analog Input X42/1	Shows the value of the signal applied to terminal X42/1 on the Analog I/O card.
[1831]	Analog Input X42/3	Shows the value of the signal applied to terminal X42/3 on the Analog I/O card.
[1832]	Analog Input X42/5	Shows the value of the signal applied to terminal X42/5 on the Analog I/O card.
[1833]	Analog Out X42/7 [V]	Shows the value of the signal applied to terminal X42/7 on the Analog I/O card.
[1834]	Analog Out X42/9 [V]	Shows the value of the signal applied to terminal X42/9 on the Analog I/O card.
[1835]	Analog Out X42/11 [V]	Shows the value of the signal applied to terminal X42/11 on the Analog I/O card.
[2117]	Ext. 1 Reference [Unit]	The value of the reference for extended Closed Loop Controller 1
[2118]	Ext. 1 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 1
[2119]	Ext. 1 Output [%]	The value of the output from extended Closed Loop Controller 1
[2137]	Ext. 2 Reference [Unit]	The value of the reference for extended Closed Loop Controller 2
[2138]	Ext. 2 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 2
[2139]	Ext. 2 Output [%]	The value of the output from extended Closed Loop Controller 2



[2157]	Ext. 3 Reference [Unit]	The value of the reference for extended Closed Loop Controller 3
[2158]	Ext. 3 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 3
[2159]	Ext. Output [%]	The value of the output from extended Closed Loop Controller 3
[2230]	No-Flow Power	The calculated No Flow Power for the actual operating speed
[2580]	Cascade Status	Status for the operation of the Cascade Controller
[2581]	Pump Status	Status for the operation of each individual pump controlled by the Cascade Controller
[2791]	Cascade Reference	Reference output for use with follower drives.
[2792]	% Of Total Capacity	Readout parameter to show the system operating point as a % capacity of total system capacity.
[2793]	Cascade Option Status	Readout parameter to show the status of the cascade system.

0-21 Display Line 1.2 Small

Option:	Function:
	Select a variable for display in line 1, middle position.
[1662] * Analog input 53	The options are the same as those listed for par. 0-20 <i>Display Line 1.1 Small</i> .

0-22 Display Line 1.3 Small

Option:	Function:
	Select a variable for display in line 1, right position.
[1614] * Motor Current	The options are the same as those listed for par. 0-20 <i>Display Line 1.1 Small</i> .

0-23 Display Line 2 Large

Option:	Function:
	Select a variable for display in line 2.
[1615] * Frequency	The options are the same as those listed for par. 0-20 <i>Display Line 1.1 Small</i> .

0-24 Display Line 3 Large

Option:	Function:
[1652] * Feedback [Unit]	The options are the same as those listed for par. 0-20 <i>Display Line 1.1 Small</i> .
	Select a variable for display in line 2.

0-37 Display Text 1

Range:	Function:
0 N/A* [0 - 0 N/A]	In this parameter it is possible to write an individual text string for display in the LCP or to be read via serial communication. If to be displayed permanently select Display Text 1 in par. 0-20 <i>Display Line 1.1 Small</i> , par. 0-21 <i>Display Line 1.2 Small</i> , par. 0-22 <i>Display Line 1.3 Small</i> , par. 0-23 <i>Display Line 2 Large</i> or par. 0-24 <i>Display Line 3 Large</i> . Use the ▲ or ▼ buttons on the LCP to change a character. Use the ◀ and ▶ buttons to move the cursor. When a character is highlighted by the cursor, it can be changed. Use the ▲ or ▼ buttons on the LCP to change a character. A character can be inserted by placing the cursor between two characters and pressing ▲ or ▼.

0-38 Display Text 2

Range:	Function:
0 N/A* [0 - 0 N/A]	In this parameter it is possible to write an individual text string for display in the LCP or to be read via serial communication. If to be displayed permanently select Display Text 2 in par. 0-20 <i>Display Line 1.1 Small</i> , par. 0-21 <i>Display Line 1.2 Small</i> , par. 0-22 <i>Display Line 1.3 Small</i> , par. 0-23 <i>Display Line 2 Large</i> or par. 0-24 <i>Display Line 3 Large</i> . Use the ▲ or ▼ buttons on the LCP to change a character. Use the ◀ and ▶ buttons to move the cursor. When a character is highlighted by the cursor, this character can be changed. A character can be inserted by placing the cursor between two characters and pressing ▲ or ▼.

8



0-69 Display Text 3

Range:	Function:
0 N/A* [0 - 0 N/A]	In this parameter it is possible to write an individual text string for display in the LCP or to be read via serial communication. If to be displayed permanently select Display Text 3 in par. 0-20 <i>Display Line 1.1 Small</i> , par. 0-21 <i>Display Line 1.2 Small</i> , par. 0-22 <i>Display Line 1.3 Small</i> , par. 0-23 <i>Display Line 2 Large</i> or par. 0-24 <i>Display Line 3 Large</i> . Use the ▲ or ▼ buttons on the LCP to change a character. Use the ◀ and ▶ buttons to move the cursor. When a character is highlighted by the cursor, this character can be changed. A character can be inserted by placing the cursor between two characters and pressing ▲ or ▼.

0-70 Set Date and Time

Range:	Function:
2000-01-01 [2000-01-01 00:00] 00:00 - 2099-12-01 23:59 *	Sets the date and time of the internal clock. The format to be used is set in par. 0-71 and 0-72.



NB!
 This parameter does not display the actual time. This can be read in par. 0-89. The clock will not begin counting until a setting different from default has been made.

0-71 Date Format

Option:	Function:
[0] * YYYY-MM-DD	Sets the date format to be used in the LCP.
[1] DD-MM-YYYY	Sets the date format to be used in the LCP.
[2] MM/DD/YYYY	Sets the date format to be used in the LCP.

0-72 Time Format

Option:	Function:
[0] * 24 h	Sets the time format to be used in the LCP.
[1] 12 h	

0-74 DST/Summertime

Option:	Function:
[0] * Off	Choose how Daylight Saving Time/Summertime should be handled. For manual DST/Summertime enter the start date and end date in par. 0-76 <i>DST/Summertime Start</i> and par. 0-77 <i>DST/Summertime End</i> .
[2] Manual	

0-76 DST/Summertime Start

Range:	Function:
0 N/A* [0 - 0 N/A]	Sets the date and time when summertime/DST starts. The date is programmed in the format selected in par. 0-71 <i>Date Format</i> .

0-77 DST/Summertime End

Range:	Function:
0 N/A* [0 - 0 N/A]	Sets the date and time when summertime/DST ends. The date is programmed in the format selected in par. 0-71 <i>Date Format</i> .



8.2.3 General Settings, 1-0*

Define whether the frequency converter operates in open loop or closed loop.

1-00 Configuration Mode

Option:	Function:
[0] * Open Loop	Motor speed is determined by applying a speed reference or by setting desired speed when in Hand Mode. Open Loop is also used if the frequency converter is part of a closed loop control system based on an external PID controller providing a speed reference signal as output.
[3] Closed Loop	Motor Speed will be determined by a reference from the built-in PID controller varying the motor speed as part of a closed loop control process (e.g. constant pressure or flow). The PID controller must be configured in par. 20-** or via the Function Setups accessed by pressing the [Quick Menus] button.



NB!
 This parameter cannot be changed when motor is running.



NB!
 When set for Closed Loop, the commands Reversing and Start Reversing will not reverse the direction of the motor.

8

1-20 Motor Power [kW]

Range:	Function:
4.00 kW* [0.09 - 3000.00 kW]	Enter the nominal motor power in kW according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running. Depending on the choices made in par. 0-03 <i>Regional Settings</i> , either par. 1-20 <i>Motor Power [kW]</i> or par. 1-21 <i>Motor Power [HP]</i> is made invisible.

1-22 Motor Voltage

Range:	Function:
400. V* [10. - 1000. V]	Enter the nominal motor voltage according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running.

1-23 Motor Frequency

Range:	Function:
50. Hz* [20. - 1000 Hz]	Select the motor frequency value from the motor nameplate data. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt par. 4-13 <i>Motor Speed High Limit [RPM]</i> and par. 3-03 <i>Maximum Reference</i> to the 87 Hz application.



NB!
 This parameter cannot be adjusted while the motor is running.



1-24 Motor Current

Range:	Function:
7.20 A* [0.10 - 10000.00 A]	Enter the nominal motor current value from the motor nameplate data. This data is used for calculating motor torque, motor thermal protection etc.

 **NB!**
 This parameter cannot be adjusted while the motor is running.

1-25 Motor Nominal Speed

Range:	Function:
1420. RPM* [100 - 60000 RPM]	Enter the nominal motor speed value from the motor nameplate data. This data is used for calculating automatic motor compensations.

 **NB!**
 This parameter cannot be changed while the motor is running.

1-29 Automatic Motor Adaptation (AMA)

Option:	Function:
[0] * Off	No function
[1] Enable complete AMA	The AMA function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters par. 1-30 <i>Stator Resistance (Rs)</i> to par. 1-35 <i>Main Reactance (Xh)</i> while the motor is stationary. performs AMA of the stator resistance R_s , the rotor resistance R_r , the stator leakage reactance X_1 , the rotor leakage reactance X_2 and the main reactance X_h .
[2] Enable reduced AMA	performs a reduced AMA of the stator resistance R_s in the system only. Select this option if an LC filter is used between the frequency converter and the motor.

Activate the AMA function by pressing [Hand on] after selecting [1] or [2]. See also the section *Automatic Motor Adaptation*. After a normal sequence, the display will read: "Press [OK] to finish AMA". After pressing the [OK] key the frequency converter is ready for operation.

Note:

- For the best adaptation of the frequency converter, run AMA on a cold motor
- AMA cannot be performed while the motor is running

 **NB!**
 It is important to set motor par. 1-2* Motor Data correctly, since these form part of the AMA algorithm. An AMA must be performed to achieve optimum dynamic motor performance. It may take up to 10 min., depending on motor power rating.

 **NB!**
 Avoid generating external torque during AMA

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NB!

If one of the settings in par. 1-2* Motor Data is changed, par. 1-30 *Stator Resistance (Rs)* to par. 1-39 *Motor Poles*, the advanced motor parameters, will return to default setting.

This parameter cannot be adjusted while the motor is running



NB!

Full AMA should be run without filter only while reduced AMA should be run with filter.

See section: *Application Examples > Automatic Motor Adaptation* in the Design Guide.

8.2.4 3-0* Reference Limits

Parameters for setting the reference unit, limits and ranges.

3-02 Minimum Reference

Range:

0.000 Ref- [-999999.999 - par. 3-03 ReferenceFeed-ceFeedbackUnit] backUnit*

Function:

Enter the Minimum Reference. The Minimum Reference is the lowest value obtainable by summing all references. The Minimum Reference value and unit matches the configuration choice made in par. 1-00 *Configuration Mode* and par. 20-12 *Reference/Feedback Unit*, respectively.



NB!

This parameter is used in open loop only.

3-03 Maximum Reference

Range:

50.000 Ref- [par. 3-02 - 999999.999 ReferenceFeed-ceFeedbackUnit] backUnit*

Function:

Enter the maximum acceptable value for the remote reference. The Maximum Reference value and unit matches the configuration choice made in par. 1-00 *Configuration Mode* and par. 20-12 *Reference/Feedback Unit*, respectively.



NB!

If operating with par. 1-00, *Configuration Mode* set for Closed Loop [3], par. 20-14, *Maximum Reference/Feedb.* must be used.

8

3-10 Preset Reference

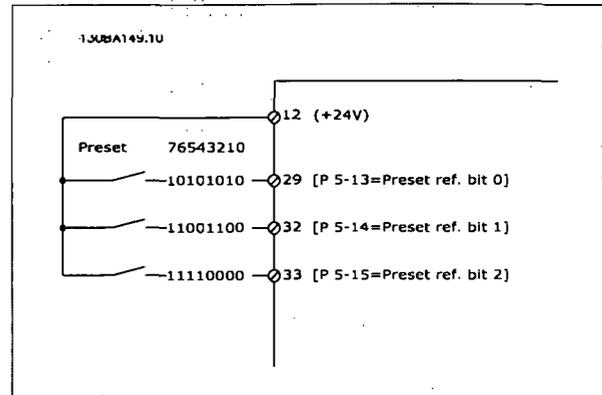
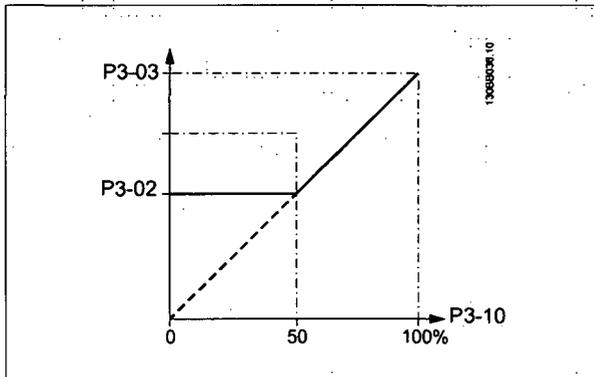
Array [8]

Range:

0.00 %* [-100.00 - 100.00 %]

Function:

Enter up to eight different preset references (0-7) in this parameter; using array programming. The preset reference is stated as a percentage of the value Ref_{MAX} (par. 3-03 *Maximum Reference*, for closed loop see par. 20-14 *Maximum Reference/Feedb.*). When using preset references, select Preset ref. bit 0 / 1 / 2 [16], [17] or [18] for the corresponding digital inputs in parameter group 5-1* Digital Inputs.



3-41 Ramp 1 Ramp Up Time

Range:

10.00 s* [1.00 - 3600.00 s]

Function:

Enter the ramp-up time, i.e. the acceleration time from 0 RPM to par. 1-25 *Motor Nominal Speed*. Choose a ramp-up time such that the output current does not exceed the current limit in par. 4-18 *Current Limit* during ramping. See ramp-down time in par. 3-42 *Ramp 1 Ramp Down Time*.

$$par.3 - 41 = \frac{tacc \times nnorm [par.1 - 25]}{ref(rpm)} [s]$$

3-42 Ramp 1 Ramp Down Time

Range:

20.00 s* [1.00 - 3600.00 s]

Function:

Enter the ramp-down time, i.e. the deceleration time from par. 1-25 *Motor Nominal Speed* to 0 RPM. Choose a ramp-down time such that no over-voltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in par. 4-18 *Current Limit*. See ramp-up time in par. 3-41 *Ramp 1 Ramp Up Time*.

$$par.3 - 42 = \frac{tdec \times nnorm [par.1 - 25]}{ref(rpm)} [s]$$

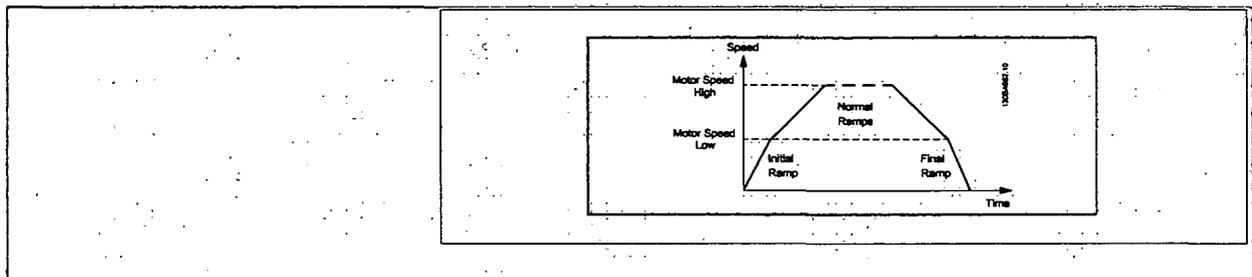
3-84 Initial Ramp Time

Range:

0 s* [0 - 60 s]

Function:

Enter the initial ramp up time from zero speed to Motor Speed Low Limit, par. 4-11 or 4-12. Submersible deep well pumps can be damaged by running below minimum speed. A fast ramp time below minimum pump speed is recommended. This parameter may be applied as a fast ramp rate from zero speed to Motor Speed Low Limit.





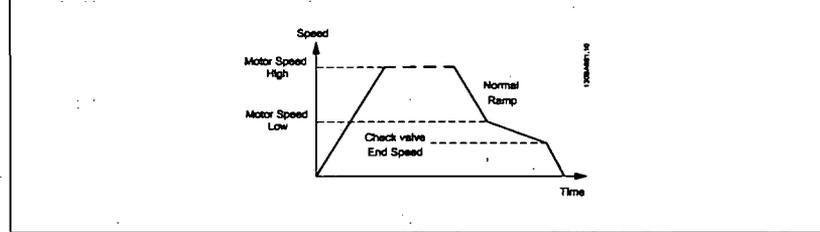
3-85 Check Valve Ramp Time

Range:

0 s* [0 – 60 s]

Function:

In order to protect ball check valves in a stop situation, the check valve ramp can be utilized as a slow ramp rate from par. 4-11 *Motor Speed Low Limit [RPM]* or par. 4-12 *Motor Speed Low Limit [Hz]*, to Check Valve Ramp End Speed, set by the user in par. 3-86 or par. 3-87. When par. 3-85 is different from 0 seconds, the Check Valve Ramp Time is effectuated and will be used to ramp down the speed from Motor Speed Low Limit to the Check Valve End Speed in par. 3-86 or par. 3-87.







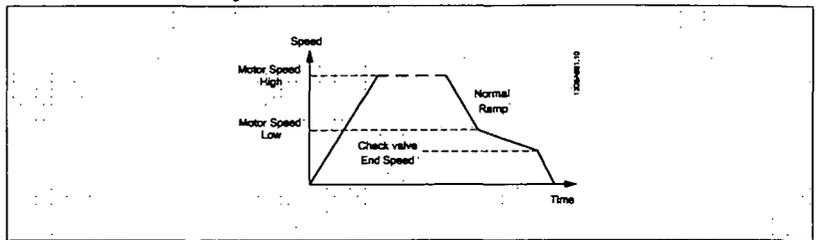
3-86 Check Valve Ramp End Speed [RPM]

Range:

0 [RPM]* [0 – Motor Speed Low Limit [RPM]]

Function:

Set the speed in [RPM] below Motor Speed Low Limit where the Check Valve is expected to be closed and the Check Valve no longer shall be active.



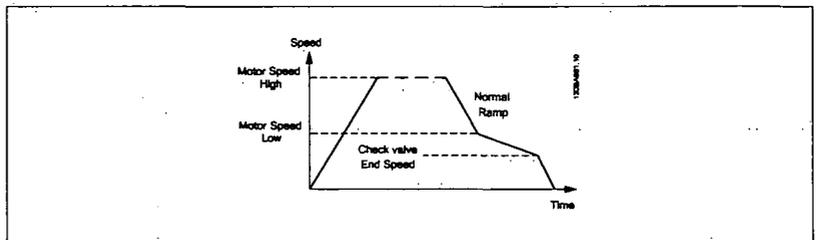
3-87 Check Valve Ramp End Speed [Hz]

Range:

0 [Hz]* [0 – Motor Speed Low Limit [Hz]]

Function:

Set the speed in [Hz] below Motor Speed Low Limit where the Check Valve Ramp will no longer be active.



8

3-88 Final Ramp Time

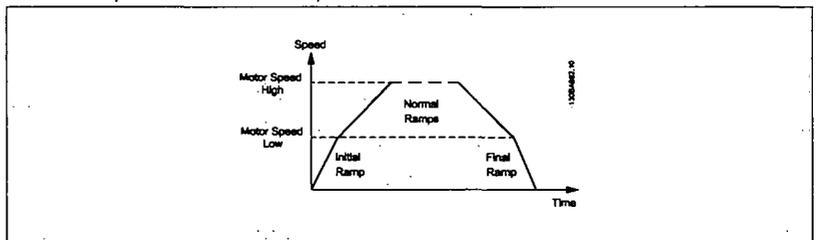
Range:

0 [s]* [0 – 60 [s]]

Function:

Enter the Final Ramp Time to be used when ramping down from Motor Speed Low Limit, par. 4-11 or 4-12, to zero speed.

Submersible deep well pumps can be damaged by running below minimum speed. A fast ramp time below minimum pump speed is recommended. This parameter may be applied as a fast ramp rate from Motor Speed Low Limit to zero speed.



8.2.5 4- Limits and Warnings**

Parameter group for configuring limits and warnings.

4-11 Motor Speed Low Limit [RPM]

Range:

0 RPM* [0 - par. 4-13 RPM]

Function:

Enter the minimum limit for motor speed. The Motor Speed Low Limit can be set to correspond to the manufacturer's recommended minimum motor speed. The Motor Speed Low Limit must not exceed the setting in par. 4-13 Motor Speed High Limit [RPM].

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4-13 Motor Speed High Limit [RPM]

Range:	Function:
1500. RPM* [par. 4-11 - 60000. RPM]	Enter the maximum limit for motor speed. The Motor Speed High Limit can be set to correspond to the manufacturer's maximum rated motor. The Motor Speed High Limit must exceed the setting in par. 4-11 <i>Motor Speed Low Limit [RPM]</i> . Only par. 4-11 <i>Motor Speed Low Limit [RPM]</i> or par. 4-12 <i>Motor Speed Low Limit [Hz]</i> will be displayed depending on other parameters in the Main Menu and depending on default settings dependant on global location.



NB!

Max. output frequency cannot exceed 10% of the inverter switching frequency (par. 14-01 *Switching Frequency*).



NB!

Any changes in par. 4-13 *Motor Speed High Limit [RPM]* will reset the value in par. 4-53 *Warning Speed High* to the same value as set in par. 4-13 *Motor Speed High Limit [RPM]*.

8.2.6 5- Digital In/Out**

Parameter group for configuring the digital input and output.

5-01 Terminal 27 Mode

Option:	Function:
[0] * Input	Defines terminal 27 as a digital input.
[1] Output	Defines terminal 27 as a digital output.

Please note that this parameter cannot be adjusted while the motor is running.

8.2.7 5-1* Digital Inputs

Parameters for configuring the input functions for the input terminals.

The digital inputs are used for selecting various functions in the frequency converter. All digital inputs can be set to the following functions:

Digital input function	Select	Terminal
No operation	[0]	All *term 32, 33
Reset	[1]	All
Coast inverse	[2]	All
Coast and reset inverse	[3]	All
DC-brake inverse	[5]	All
Stop inverse	[6]	All
External interlock	[7]	All
Start	[8]	All *term 18
Latched start	[9]	All
Reversing	[10]	All *term 19
Start reversing	[11]	All
Jog	[14]	All *term 29
Preset reference on	[15]	All
Preset ref bit 0	[16]	All
Preset ref bit 1	[17]	All
Preset ref bit 2	[18]	All
Freeze reference	[19]	All
Freeze output	[20]	All
Speed up	[21]	All
Speed down	[22]	All
Set-up select bit 0	[23]	All
Set-up select bit 1	[24]	All
Pulse input	[32]	term 29, 33
Ramp bit 0	[34]	All
Mains failure inverse	[36]	All
Run Permissive	[52]	



Hand start	[53]	
Auto start	[54]	
DigiPot Increase	[55]	All
DigiPot Decrease	[56]	All
DigiPot Clear	[57]	All
Counter A (up)	[60]	29, 33
Counter A (down)	[61]	29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	29, 33
Counter B (down)	[64]	29, 33
Reset Counter B	[65]	All
Sleep Mode	[66]	
Reset Maintenance Word	[78]	
Lead Pump Start	[120]	
Lead Pump Alternation	[121]	
Pump 1 Interlock	[130]	
Pump 2 Interlock	[131]	
Pump 3 Interlock	[132]	

All.= Terminals 18, 19, 27, 29, 32, X30/2, X30/3, X30/4. X30/ are the terminals on MCB 101.

Functions dedicated to only one digital input are stated in the associated parameter.

All digital inputs can be programmed to these functions:

[0]	No operation	No reaction to signals transmitted to terminal.
[1]	Reset	Resets frequency converter after a TRIP/ALARM. Not all alarms can be reset.
[2]	Coast inverse	Leaves motor in free mode. Logic '0' => coasting stop. (Default Digital input 27): Coasting stop, inverted input (NC).
[3]	Coast and reset inverse	Reset and coasting stop Inverted input (NC). Leaves motor in free mode and resets the frequency converter. Logic '0' => coasting stop and reset.
[5]	DC-brake inverse	Inverted input for DC braking (NC). Stops motor by energizing it with a DC current for a certain time period. See par. 2-01 to par. 2-03. The function is only active when the value in par. 2-02 is different from 0. Logic '0' => DC braking.
[6]	Stop inverse	Stop Inverted function. Generates a stop function when the selected terminal goes from logical level '1' to '0'. The stop is performed according to the selected ramp time (par. 3-42 and par. 3-52).
<div style="display: flex; align-items: center;"> <div> <p>NB!</p> <p>When the frequency converter is at the torque limit and has received a stop command, it may not stop by itself. To ensure that the frequency converter stops, configure a digital output to <i>Torque limit & stop</i> [27] and connect this digital output to a digital input that is configured as coast.</p> </div> </div>		
[7]	External Interlock	Same function as Coasting stop, inverse, but External Interlock generates the alarm message 'external fault' on the display when the terminal which is programmed for Coast Inverse is logic '0'. The alarm message will also be active via digital outputs and relay outputs, if programmed for External Interlock. The alarm can be reset using a digital input or the [RESET] key if the cause for the External Interlock has been removed. A delay can be programmed in par. 22-00, External Interlock Time. After applying a signal to the input, the reaction described above will be delayed with the time set in par. 22-00.
[8]	Start	Select start for a start/stop command. Logic '1' = start, logic '0' = stop. (Default Digital input 18)
[9]	Latched start	Motor starts, if a pulse is applied for min. 2 ms. Motor stops when Stop inverse is activated
[10]	Reversing	Changes direction of motor shaft rotation. Select Logic '1' to reverse. The reversing signal only changes the direction of rotation. It does not activate the start function. Select both directions in par. 4-10 <i>Motor Speed Direction</i> . (Default Digital input 19).
[11]	Start reversing	Used for start/stop and for reversing on the same wire. Signals on start are not allowed at the same time.
[14]	Jog	Used for activating jog speed. See par. 3-11. (Default Digital input 29)

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[15] Preset reference on Used for shifting between external reference and preset reference. It is assumed that *External/preset* [1] has been selected in par. 3-04. Logic '0' = external reference active; logic '1' = one of the eight preset references is active.

[16] Preset ref bit 0 Enables a choice between one of the eight preset references according to the table below.

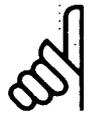
[17] Preset ref bit 1 Enables a choice between one of the eight preset references according to the table below.

[18] Preset ref bit 2 Enables a choice between one of the eight preset references according to the table below.

Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1

[19] Freeze ref Freezes actual reference: The frozen reference is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (par. 3-51 and 3-52) in the range 0 - par. 3-03 *Maximum Reference*.

[20] Freeze output Freezes actual motor frequency (Hz). The frozen motor frequency is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (par. 3-51 and 3-52) in the range 0 - par. 1-23 *Motor Frequency*.



NB!

When Freeze output is active, the frequency converter cannot be stopped via a low 'start [13]' signal. Stop the frequency converter via a terminal programmed for Coasting inverse [2] or Coast and reset, inverse [3].

[21] Speed up For digital control of the up/down speed is desired (motor potentiometer). Activate this function by selecting either Freeze reference or Freeze output. When Speed up is activated for less than 400 msec. the resulting reference will be increased by 0.1 %. If Speed up is activated for more than 400 msec. the resulting reference will ramp according to Ramp 1 in par. 3-41.

[22] Speed down Same as Speed up [21].

[23] Set-up select bit 0 Selects one of the four set-ups. Set par. 0-10 *Active Set-up* to Multi Set-up.

[24] Set-up select bit 1 Same as Set-up select bit 0 [23].
(Default Digital input 32)

[32] Pulse input Select Pulse input when using a pulse sequence as either reference or feedback. Scaling is done in par. group 5-5*.

[34] Ramp bit 0 Select which ramp to use. Logic "0" will select ramp 1 while logic "1" will select ramp 2.

[36] Mains failure inverse Activates par. 14-10 *Mains Failure*. Mains failure inverse is active in the Logic "0" situation.

[52] Run Permissive The input terminal, for which the Run permissive has been programmed must be logic "1" before a start command can be accepted. Run permissive has a logic 'AND' function related to the terminal which is programmed for *START* [8], *Jog* [14] or *Freeze Output* [20], which means that in order to start running the motor, both conditions must be fulfilled. If Run Permissive is programmed on multiple terminals, Run permissive needs only be logic '1' on one of the terminals for the function to be carried out. The digital output signal for Run Request (*Start* [8], *Jog* [14] or *Freeze output* [20]) programmed in par. 5-3* Digital outputs, or par. 5-4* Relays, will not be affected by Run Permissive.

[53] Hand start A signal applied will put the frequency converter into Hand mode as if button *Hand On* on the LCP has been pressed and a normal stop command will be overridden. If disconnecting the signal, the motor will stop. To make any other start commands valid, another digital input must be assign to *Auto Start* and a signal applied to this. The *Hand On* and *Auto On* buttons on the LCP has no impact. The *Off* button on the LCP will override *Hand Start* and *Auto Start*. Press either the *Hand On* or *Auto On* button to make *Hand Start* and *Auto Start* active again. If no signal on neither *Hand Start* nor *Auto Start*, the motor will stop regardless of any normal Start command applied. If signal applied to both *Hand Start* and *Auto Start*, the function will be *Auto Start*. If pressing the *Off* button on the LCP the motor will stop regardless of signals on *Hand Start* and *Auto Start*.



[54]	Auto start	A signal applied will put the frequency converter into Auto mode as if the LCP button <i>Auto On</i> has been pressed. See also <i>Hard Start</i> [53]
[55]	DigiPot Increase	Uses the input as an INCREASE signal to the Digital Potentiometer function described in parameter group 3-9*
[56]	DigiPot Decrease	Uses the input as a DECREASE signal to the Digital Potentiometer function described in parameter group 3-9*
[57]	DigiPot Clear	Uses the input to CLEAR the Digital Potentiometer reference described in parameter group 3-9*
[60]	Counter A (up)	(Terminal 29 or 33 only) Input for increment counting in the SLC counter.
[61]	Counter A (down)	(Terminal 29 or 33 only) Input for decrement counting in the SLC counter.
[62]	Reset Counter A	Input for reset of counter A.
[63]	Counter B (up)	(Terminal 29 and 33 only) Input for increment counting in the SLC counter.
[64]	Counter B (down)	(Terminal 29 and 33 only) Input for decrement counting in the SLC counter.
[65]	Reset Counter B	Input for reset of counter B.
[66]	Sleep Mode	Forces frequency converter into Sleep Mode (see par. 22-4*, Sleep Mode). Reacts on the rising edge of signal applied!
[78]	Reset Preventive Maintenance Word	Resets all data in par. 16-96, Preventive Maintenance Word, to 0.

The below setting options are all related to the Cascade Controller. Wiring diagrams and settings for parameter, see group 25-** for more details.

[120]	Lead Pump Start	Starts/Stops the Lead Pump (controlled by the frequency converter). A start requires that also a System Start signal has been applied e.g. to one of the digital inputs set for <i>Start</i> [8]!
[121]	Lead Pump Alternation	Forces alternation of the lead pump in a Cascade Controller. <i>Lead Pump Alternation</i> , par. 25-50, must be set to either <i>At Command</i> [2] or <i>At Staging or At Command</i> [3]. <i>Alternation Event</i> , par. 25-51, can be set to any of the four options.

[130 - 138] Pump1 Interlock - Pump9 Interlock The function will depend on the setting in par. 25-06, Number of Pumps. If set to *No* [0], then Pump1 refers to the pump controlled by relay RELAY1 etc. If set to *Yes* [1], Pump1 refers to the pump controlled by the frequency converter only (without any of the build in relays involved) and Pump2 to the pump controlled by the relay RELAY1. Variable speed pump (lead) cannot be interlocked in the basic Cascade Controller.
 See below table:

Setting in Par. 5-1*	Setting in Par. 25-06	
	[0] No	[1] Yes
[130] Pump1 Interlock	Controlled by RELAY1 (only if not lead pump)	Frequency Converter controlled (cannot be interlocked)
[131] Pump2 Interlock	Controlled by RELAY2	Controlled by RELAY1
[132] Pump3 Interlock	Controlled by RELAY3	Controlled by RELAY2
[133] Pump4 Interlock	Controlled by RELAY4	Controlled by RELAY3
[134] Pump5 Interlock	Controlled by RELAY5	Controlled by RELAY4
[135] Pump6 Interlock	Controlled by RELAY6	Controlled by RELAY5
[136] Pump7 Interlock	Controlled by RELAY7	Controlled by RELAY6
[137] Pump8 Interlock	Controlled by RELAY8	Controlled by RELAY7
[138] Pump9 Interlock	Controlled by RELAY9	Controlled by RELAY8

5-13 Terminal 29 Digital Input

Option: [0] * No Operation **Function:** Same options and functions as par. 5-1* *Digital Inputs*

5-14 Terminal 32 Digital Input

Same options and functions as par. 5-1*, except for *Pulse input*

Option: [0] * No operation



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5-15 Terminal 33 Digital Input

Same options and functions as par. 5-1* Digital Inputs.

Option: **Function:**

[0] * No operation

5-30 Terminal 27 Digital Output

Same options and functions as par. 5-3*.

Option: **Function:**

[0] * No operation

5-40 Function Relay

Array [8] (Relay 1 [0], Relay 2 [1], Relay 7 [6], Relay 8 [7], Relay 9 [8])

Select options to define the function of the relays.

The selection of each mechanical relay is realized in an array parameter.

[0] * No Operation

[1] Control Ready

[2] Drive Ready

[3] Drive Ready/Remote

[4] Stand-by/No Warning

[5] Running

[6] Running/No Warning

[8] Run on Ref./No Warning

[9] Alarm

[10] Alarm or Warning

[11] At Torque Limit

[12] Out of Current Range

[13] Below Current, low

[14] Above Current, high

[15] Out of Speed Range

[16] Below Speed, low

[17] Above Speed, high

[18] Out of Feedb. Range

[19] Below Feedback, low

[20] Above Feedback, high

[21] Thermal Warning

[25] Reverse

[26] Bus OK

[27] Torque Limit & Stop

[28] Brake, No Warning

[29] Brake Ready, No Fault

[30] Brake Fault (IGBT)

[35] External Interlock

[36] Control Word Bit 11

[37] Control Word Bit 12

[40] Out of Ref. Range

[41] Below Reference, low

8



[42]	Above Ref. high
[45]	Bus ctrl
[46]	Bus ctrl, 1 if timeout
[47]	Bus ctrl, 0 if timeout
[60]	Comparator 0
[61]	Comparator 1
[62]	Comparator 2
[63]	Comparator 3
[64]	Comparator 4
[65]	Comparator 5
[70]	Logic Rule 0
[71]	Logic Rule 1
[72]	Logic Rule 2
[73]	Logic Rule 3
[74]	Logic Rule 4
[75]	Logic Rule 5
[80]	SL Digital Output A
[81]	SL Digital Output B
[82]	SL Digital Output C
[83]	SL Digital Output D
[84]	SL Digital Output E
[85]	SL Digital Output F
[160]	No Alarm
[161]	Running Reverse
[165]	Local Ref. Active
[166]	Remote Ref. Active
[167]	Start.Cmd. Active
[168]	Drive in Hand Mode
[169]	Drive in Auto Mode
[180]	Clock Fault
[181]	Prev. Maintenance
[190]	No-Flow
[191]	Dry Pump
[192]	End of Curve
[193]	Sleep Mode
[194]	Broken Belt
[195]	Bypass Valve Control
[199]	Pipe Filling
[211]	Cascade Pump1
[212]	Cascade Pump2
[213]	Cascade Pump3
[223]	Alarm, Trip Locked
[224]	Bypass Mode Active

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5-53 Term. 29 High Ref./Feedb. Value

Range:	Function:
100.000 N/ [-999999.999 - 999999.999 N/A] A*	Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also par. 5-58 <i>Term. 33 High Ref./Feedb. Value.</i>

8.2.8 6- Analog In/Out**

Parameter group for configuration of the analog input and output.

6-00 Live Zero Timeout Time

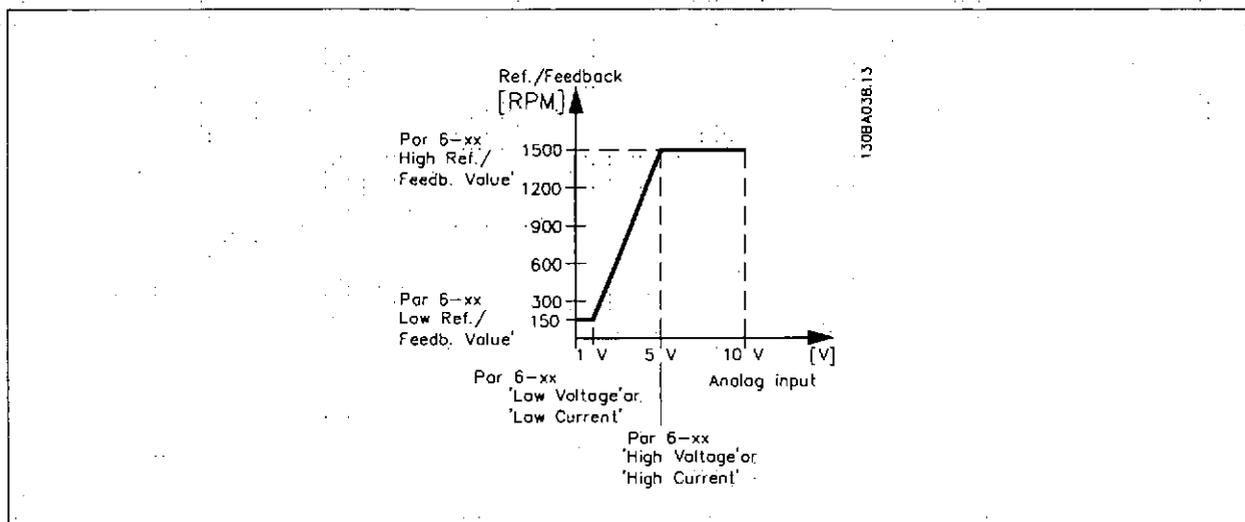
Range:	Function:
10 s* [1 - 99 s]	Enter the Live Zero Time-out time period. Live Zero Time-out Time is active for analog inputs, i.e. terminal 53 or terminal 54, used as reference or feedback sources. If the reference signal value associated with the selected current input falls below 50% of the value set in par. 6-10 <i>Terminal 53 Low Voltage</i> , par. 6-12 <i>Terminal 53 Low Current</i> , par. 6-20 <i>Terminal 54 Low Voltage</i> or par. 6-22 <i>Terminal 54 Low Current</i> for a time period longer than the time set in par. 6-00 <i>Live Zero Timeout Time</i> , the function selected in par. 6-01 <i>Live Zero Timeout Function</i> will be activated.

6-01 Live Zero Timeout Function

Option:	Function:
	<p>Select the time-out function. The function set in par. 6-01 <i>Live Zero Timeout Function</i> will be activated if the input signal on terminal 53 or 54 is below 50% of the value in par. 6-10 <i>Terminal 53 Low Voltage</i>, par. 6-12 <i>Terminal 53 Low Current</i>, par. 6-20 <i>Terminal 54 Low Voltage</i> or par. 6-22 <i>Terminal 54 Low Current</i> for a time period defined in par. 6-00 <i>Live Zero Timeout Time</i>. If several time-outs occur simultaneously, the frequency converter prioritises the time-out functions as follows:</p> <ol style="list-style-type: none"> 1. par. 6-01 <i>Live Zero Timeout Function</i> 2. par. 8-04 <i>Control Timeout Function</i> <p>The output frequency of the frequency converter can be:</p> <ul style="list-style-type: none"> • [1] frozen at the present value • [2] overruled to stop • [3] overruled to jog speed • [4] overruled to max. speed • [5] overruled to stop with subsequent trip

[0] *	Off
[1]	Freeze output
[2]	Stop
[3]	Jogging
[4]	Max. speed
[5]	Stop and trip

8



6-10 Terminal 53 Low Voltage

Range:	Function:
0.07 V* [0.00 - par. 6-11 V]	Enter the low voltage value. This analog input scaling value should correspond to the low reference/feedback value set in par. 6-14 Terminal 53 Low Ref./Feedb. Value.

6-11 Terminal 53 High Voltage

Range:	Function:
10.00 V* [par. 6-10 - 10.00 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference/feedback value set in par. 6-15 Terminal 53 High Ref./Feedb. Value.

6-14 Terminal 53 Low Ref./Feedb. Value

Range:	Function:
0.000 N/A* [-999999.999 - 999999.999 N/A]	Enter the analog input scaling value that corresponds to the low voltage/low current set in par. 6-10 Terminal 53 Low Voltage and par. 6-12 Terminal 53 Low Current.

6-15 Terminal 53 High Ref./Feedb. Value

Range:	Function:
50.000 N/A* [-999999.999 - 999999.999 N/A]	Enter the analog input scaling value that corresponds to the high voltage/high current value set in par. 6-11 Terminal 53 High Voltage and par. 6-13 Terminal 53 High Current.

6-20 Terminal 54 Low Voltage

Range:	Function:
0.07 V* [0.00 - par. 6-21 V]	Enter the low voltage value. This analog input scaling value should correspond to the low reference/feedback value, set in par. 6-24 Terminal 54 Low Ref./Feedb. Value.

6-21 Terminal 54 High Voltage

Range:	Function:
10.00 V* [par. 6-20 - 10.00 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference/feedback value set in par. 6-25 Terminal 54 High Ref./Feedb. Value.

6-24 Terminal 54 Low Ref./Feedb. Value

Range:	Function:
0.000 N/A* [-999999.999 - 999999.999 N/A]	Enter the analog input scaling value that corresponds to the low voltage/low current value set in par. 6-20 Terminal 54 Low Voltage and par. 6-22 Terminal 54 Low Current.

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6-25 Terminal 54 High Ref./Feedb. Value

Range:	Function:
100.000 ·N/ [-999999.999 - 999999.999 N/A] A*	Enter the analog input scaling value that corresponds to the high voltage/high current value set in par. 6-21 <i>Terminal 54 High Voltage</i> and par. 6-23 <i>Terminal 54 High Current</i> .

6-50 Terminal 42 Output

Option:	Function:
	Select the function of Terminal 42 as an analog current output. A motor current of 20 mA corresponds to I_{max} .

[0] *	No operation	
[100]	Output freq. 0-100	: 0 - 100 Hz, (0-20 mA)
[101]	Reference Min-Max	: Minimum reference - Maximum reference, (0-20 mA)
[102]	Feedback +200%	: -200% to +200% of par. 20-14, (0-20 mA)
[103]	Motor cur. 0-Imax	: 0 - Inverter Max. Current (par. 16-37), (0-20 mA)
[104]	Torque 0-Tlim	: 0 - Torque limit (par. 4-16), (0-20 mA)
[105]	Torque 0-Tnom	: 0 - Motor rated torque, (0-20 mA)
[106]	Power 0-Pnom	: 0 - Motor rated power, (0-20 mA)
[107] *	Speed 0-HighLim	: 0 - Speed High Limit (par. 4-13 and par. 4-14), (0-20 mA)
[113]	Ext. Closed Loop 1	: 0 - 100%, (0-20 mA)
[114]	Ext. Closed Loop 2	: 0 - 100%, (0-20 mA)
[115]	Ext. Closed Loop 3	: 0 - 100%, (0-20 mA)
[130]	Out frq 0-100 4-20mA	: 0 - 100 Hz
[131]	Reference 4-20mA	: Minimum Reference - Maximum Reference
[132]	Feedback 4-20mA	: -200% to +200% of par. 20-14 <i>Maximum Reference/Feedb.</i>
[133]	Motor cur. 4-20mA	: 0 - Inverter Max. Current (par. 16-37 <i>Inv. Max. Current</i>)
[134]	Torq.0-lim 4-20 mA	: 0 - Torque limit (par. 4-16)
[135]	Torq.0-nom 4-20mA	: 0 - Motor rated torque
[136]	Power 4-20mA	: 0 - Motor rated power
[137]	Speed 4-20mA	: 0 - Speed High Limit (4-13 and 4-14)
[139]	Bus ctrl.	: 0 - 100%, (0-20 mA)
[140]	Bus ctrl. 4-20 mA	: 0 - 100%
[141]	Bus ctrl t.o.	: 0 - 100%, (0-20 mA)
[142]	Bus ctrl t.o. 4-20mA	: 0 - 100%
[143]	Ext. CL 1 4-20mA	: 0 - 100%
[144]	Ext. CL 2 4-20mA	: 0 - 100%
[145]	Ext. CL 3 4-20mA	: 0 - 100%

NB!

Values for setting the Minimum Reference is found in open loop par. 3-02 *Minimum Reference* and for closed loop par. 20-13 *Minimum Reference/Feedb.* - values for maximum reference for open loop is found in par. 3-03 *Maximum Reference* and for closed loop par. 20-14 *Maximum Reference/Feedb.*



6-51 Terminal 42 Output Min Scale

Range:

0.00 %* [0.00 - 200.00 %]

Function:

Scale for the minimum output (0 or 4 mA) of the analogue signal at terminal 42.
 Set the value to be the **percentage** of the full range of the variable selected in par. 6-50 *Terminal 42 Output*.

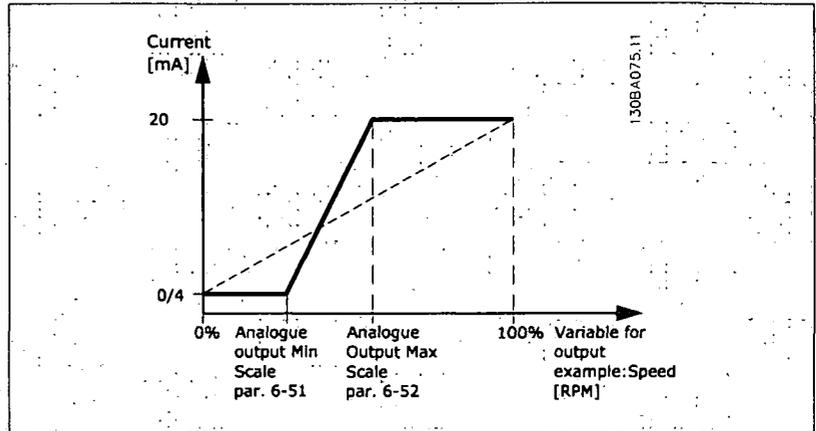
6-52 Terminal 42 Output Max Scale

Range:

100.00 %* [0.00 - 200.00 %]

Function:

Scale for the maximum output (20 mA) of the analog signal at terminal 42.
 Set the value to be the percentage of the full range of the variable selected in par. 6-50 *Terminal 42 Output*.



It is possible to get a value lower than 20 mA at full scale by programming values >100% by using a formula as follows:

$$20 \text{ mA} \mid \text{desired maximum current} \times 100 \%$$

i.e. 10 mA : $\frac{20 \text{ mA}}{10 \text{ mA}} \times 100 \% = 200 \%$

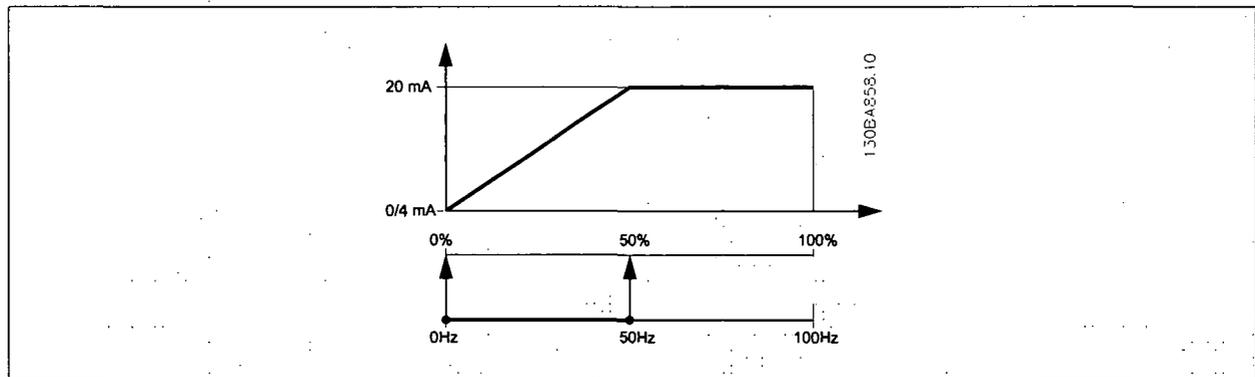
EXAMPLE 1:

Variable value= OUTPUT FREQUENCY, range = 0-100 Hz

Range needed for output = 0-50 Hz

Output signal 0 or 4 mA is needed at 0 Hz (0% of range) - set par. 6-51 *Terminal 42 Output Min Scale* to 0%

Output signal 20 mA is needed at 50 Hz (50% of range) - set par. 6-52 *Terminal 42 Output Max Scale* to 50%



8 How to Programme the Frequency Converter



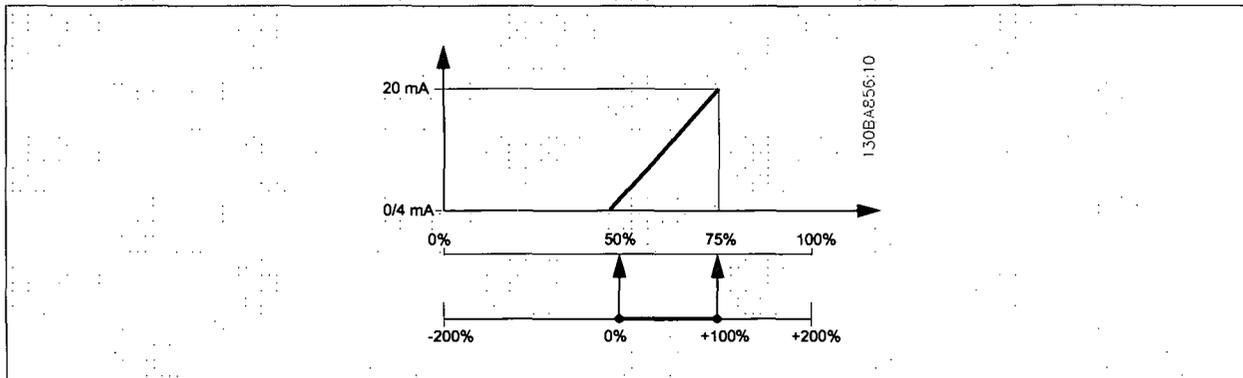
EXAMPLE 2:

Variable= FEEDBACK, range= -200% to +200%

Range needed for output= 0-100%

Output signal 0 or 4 mA is needed at 0% (50% of range) - set par. 6-51 Terminal 42 Output Min Scale to 50%

Output signal 20 mA is needed at 100% (75% of range) - set par. 6-52 Terminal 42 Output Max Scale to 75%



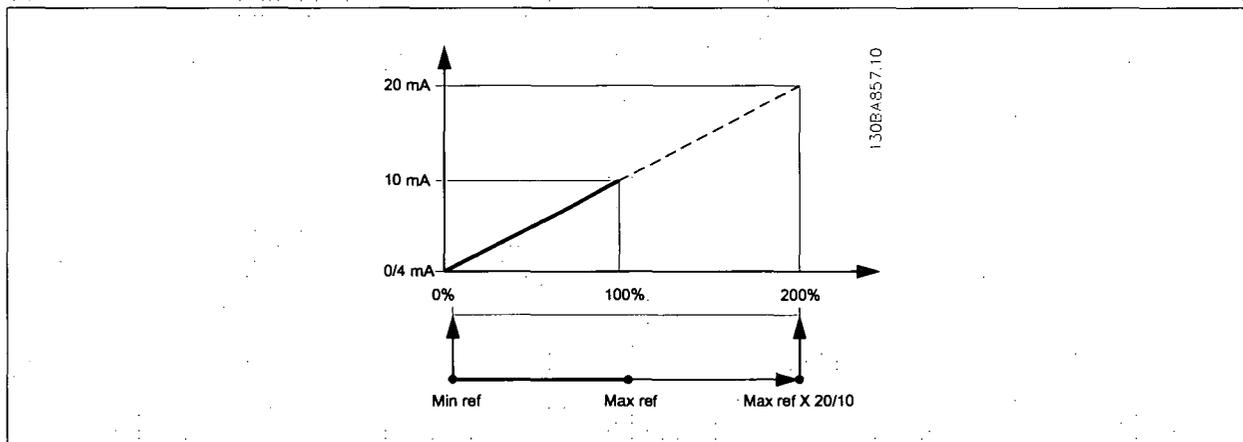
EXAMPLE 3:

Variable value= REFERENCE, range= Min ref - Max ref

Range needed for output= Min ref (0%) - Max ref (100%), 0-10 mA

Output signal 0 or 4 mA is needed at Min ref - set par. 6-51 Terminal 42 Output Min Scale to 0%

Output signal 10 mA is needed at Max ref (100% of range) - set par. 6-52 Terminal 42 Output Max Scale to 200%
(20 mA / 10 mA x 100%=200%).



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8.2.9 Drive Closed Loop, 20-**

This parameter group is used for configuring the closed loop PID Controller, that controls the output frequency of the frequency converter.

20-12 Reference/Feedback Unit

Option:	Function:
[0] None	
[1] *	%
[5]	PPM
[10]	1/min
[11]	RPM
[12]	Pulse/s
[20]	l/s
[21]	l/min



[22]	l/h
[23]	m ³ /s
[24]	m ³ /min
[25]	m ³ /h
[30]	kg/s
[31]	kg/min
[32]	kg/h
[33]	t/min
[34]	t/h
[40]	m/s
[41]	m/min
[45]	m
[60]	°C
[70]	mbar
[71]	bar
[72]	Pa
[73]	kPa
[74]	m WG
[75]	mm Hg
[80]	kW
[120]	GPM
[121]	gal/s
[122]	gal/min
[123]	gal/h
[124]	CFM
[125]	ft ³ /s
[126]	ft ³ /min
[127]	ft ³ /h
[130]	lb/s
[131]	lb/min
[132]	lb/h
[140]	ft/s
[141]	ft/min
[145]	ft
[160]	°F
[170]	psi
[171]	lb/in ²
[172]	in WG
[173]	ft WG
[174]	in Hg
[180]	HP

This parameter determines the unit that is used for the setpoint reference and feedback that the PID Controller will use for controlling the output frequency of the frequency converter.

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**20-21 Setpoint 1****Range:**

0.000 Proc- [-999999.999 - 999999.999 Proc-
essCtrlU- essCtrlUnit]
nit*

Function:

Setpoint 1 is used in Closed Loop Mode to enter a setpoint reference that is used by the frequency converter's PID Controller. See the description of par. 20-20 *Feedback Function*.

**NB!**

Setpoint reference entered here is added to any other references that are enabled (see par. group 3-1*).

20-81 PID Normal/Inverse Control**Option:**

[0] * Normal

Function:

[1] Inverse

Normal [0] causes the frequency converter's output frequency to decrease when the feedback is greater than the setpoint reference. This is common for pressure-controlled supply fan and pump applications.

Inverse [1] causes the frequency converter's output frequency to increase when the feedback is greater than the setpoint reference.

20-82 PID Start Speed [RPM]**Range:**

0 RPM* [0 - par. 4-13 RPM]

Function:

When the frequency converter is first started, it initially ramps up to this output speed in Open Loop Mode, following the active Ramp Up Time. When the output speed programmed here is reached, the frequency converter will automatically switch to Closed Loop Mode and the PID Controller will begin to function. This is useful in applications in which the driven load must first quickly accelerate to a minimum speed when it is started.

**NB!**

This parameter will only be visible if par. 0-02 *Motor Speed Unit* is set to [0], RPM.

20-93 PID Proportional Gain**Range:**

0.50 N/A* [0.00 - 10.00 N/A]

Function:

If (Error x Gain) jumps with a value equal to what is set in par. 20-14 *Maximum Reference/Feedb.* the PID controller will try to change the output speed equal to what is set in par. 4-13 *Motor Speed High Limit [RPM]*/par. 4-14 *Motor Speed High Limit [Hz]* but in practice of course limited by this setting. The proportional band (error causing output to change from 0-100%) can be calculated by means of the formula:

$$\left(\frac{1}{\text{Proportional Gain}} \right) \times (\text{Max Reference})$$

NB!

Always set the desired for par. 20-14 *Maximum Reference/Feedb.* before setting the values for the PID controller in par. group 20-9*.



20-94 PID Integral Time

Range:	Function:
20.00 s* [0.01 - 10000.00 s]	<p>Over time, the integrator accumulates a contribution to the output from the PID controller as long as there is a deviation between the Reference/Setpoint and feedback signals. The contribution is proportional to the size of the deviation. This ensures that the deviation (error) approaches zero. Quick response on any deviation is obtained when the integral time is set to a low value. Setting it too low, however, may cause the control to become unstable.</p> <p>The value set, is the time needed for the integrator to add the same contribution as the proportional part for a certain deviation.</p> <p>If the value is set to 10,000, the controller will act as a pure proportional controller with a P-band based on the value set in par. 20-93 <i>PID Proportional Gain</i>. When no deviation is present, the output from the proportional controller will be 0.</p>

8.2.10 22- Miscellaneous**

This group contains parameters used for monitoring water/ wastewater applications.

22-20 Low Power Auto Set-up

Option:	Function:
[0] * Off	<p>When set for <i>Enabled</i>, an auto set up sequence is activated, automatically setting speed to approx. 50 and 85% of rated motor speed (par. 4-13 <i>Motor Speed High Limit [RPM]</i>, par. 4-14 <i>Motor Speed High Limit [Hz]</i>). At those two speeds, the power consumption is automatically measured and stored.</p> <p>Before enabling Auto Set Up:</p> <ol style="list-style-type: none"> 1. Close valve(s) in order to create a no flow condition. 2. The frequency converter must be set for Open Loop (par. 1-00 <i>Configuration Mode</i>). <p>Note that it is important also to set par. 1-03 <i>Torque Characteristics</i>.</p>
[1] Enabled	

 **NB!**
 Auto Set Up must be done when the system has reached normal operating temperature!

 **NB!**
 It is important that the par. 4-13 *Motor Speed High Limit [RPM]* or par. 4-14 *Motor Speed High Limit [Hz]* is set to the max. operational speed of the motor!
 It is important to do the Auto Set-up before configuring the integrated PI Controller as settings will be reset when changing from Closed to Open Loop in par. 1-00 *Configuration Mode*.

 **NB!**
 Carry out the tuning with the same settings in par. 1-03 *Torque Characteristics*, as for operation after the tuning.

22-21 Low Power Detection

Option:	Function:
[0] * Disabled	<p>If selecting <i>Enabled</i>, the Low Power Detection commissioning must be carried out in order to set the parameters in group 22-3* for proper operation!</p>
[1] Enabled	

**22-22 Low Speed Detection**

Option:	Function:
[0] * Disabled	
[1] Enabled	Select Enabled for detecting when the motor operates with a speed as set in par. 4-11 <i>Motor Speed Low Limit [RPM]</i> or par. 4-12 <i>Motor Speed Low Limit [Hz]</i> .

22-23 No-Flow Function

Option:	Function:
[0] * Off	Common actions for Low Power Detection and Low Speed Detection (Individual selections not possible).
[1] Sleep Mode	
[2] Warning	Messages in the Local Control Panel display (if mounted) and/or signal via a relay or a digital output.
[3] Alarm	The frequency converter trips and motor stays stopped until reset.

22-24 No-Flow Delay

Range:	Function:
10 s* [1 - 600 s]	Set the time Low Power/Low Speed must stay detected to activate signal for actions. If detection disappears before run out of the timer, the timer will be reset.

22-26 Dry Pump Function

Option:	Function:
[0] * Off	<i>Low Power Detection</i> must be Enabled (par. 22-21 <i>Low Power Detection</i>) and commissioned (using either parameter group 22-3*, <i>No Flow Power Tuning</i> , or par. 22-20 <i>Low Power Auto Set-up</i>) in order to use Dry Pump Detection.
[1] Warning	Messages in the Local Control Panel display (if mounted) and/or signal via a relay or a digital output.
[2] Alarm	The frequency converter trips and motor stays stopped until reset.

22-27 Dry Pump Delay

Range:	Function:
10 s* [0 - 600 s]	Defines for how long the Dry Pump condition must be active before activating Warning or Alarm

22-30 No-Flow Power

Range:	Function:
0.00 kW* [0.00 - 0.00 kW]	Read-out of calculated No Flow power at actual speed. If power drops to the display value the frequency converter will consider the condition as a No Flow situation.

22-31 Power Correction Factor

Range:	Function:
100 %* [1 - 400 %]	Make corrections to the calculated power at par. 22-30 <i>No-Flow Power</i> . If No Flow is detected, when it should not be detected, the setting should be decreased. However, if No Flow is not detected, when it should be detected, the setting should be increased to above 100%.

22-32 Low Speed [RPM]

Range:	Function:
0 RPM* [0 - par. 22-36 RPM]	To be used if par. 0-02 <i>Motor Speed Unit</i> has been set for RPM (parameter not visible if Hz selected). Set used speed for the 50% level. This function is used for storing values needed to tune No Flow Detection.

22-33 Low Speed [Hz]

Range:	Function:
0 Hz* [0.0 - par. 22-37 Hz]	To be used if par. 0-02 <i>Motor Speed Unit</i> has been set for Hz (parameter not visible if RPM selected). Set used speed for the 50% level. The function is used for storing values needed to tune No Flow Detection.

22-34 Low Speed Power [kW]

Range:	Function:
0 kW* [0.00 - 0.00 kW]	To be used if par. 0-03 <i>Regional Settings</i> has been set for International (parameter not visible if North America selected). Set power consumption at 50% speed level. This function is used for storing values needed to tune No Flow Detection.

22-35 Low Speed Power [HP]

Range:	Function:
0 hp* [0.00 - 0.00 hp]	To be used if par. 0-03 <i>Regional Settings</i> has been set for North America (parameter not visible if International selected). Set power consumption at 50% speed level. This function is used for storing values needed to tune No Flow Detection.

22-36 High Speed [RPM]

Range:	Function:
0 RPM* [0 - par. 4-13 RPM]	To be used if par. 0-02 <i>Motor Speed Unit</i> has been set for RPM (parameter not visible if Hz selected). Set used speed for the 85% level. The function is used for storing values needed to tune No Flow Detection.

22-37 High Speed [Hz]

Range:	Function:
0.0 Hz* [0.0 - par. 4-14 Hz]	To be used if par. 0-02 <i>Motor Speed Unit</i> has been set for Hz (parameter not visible if RPM selected). Set used speed for the 85% level. The function is used for storing values needed to tune No Flow Detection.

22-38 High Speed Power [kW]

Range:	Function:
0 kW* [0.00 - 0.00 kW]	To be used if par. 0-03 <i>Regional Settings</i> has been set for International (parameter not visible if North America selected). Set power consumption at 85% speed level. This function is used for storing values needed to tune No Flow Detection.

22-39 High Speed Power [HP]

Range:	Function:
0 hp* [0.00 - 0.00 hp]	To be used if par. 0-03 <i>Regional Settings</i> has been set for North America (parameter not visible if International selected). Set power consumption at 85% speed level. This function is used for storing values needed to tune No Flow Detection.

22-40 Minimum Run Time

Range:	Function:
10 s* [0 - 600 s]	Set the desired minimum running time for the motor after a start command (digital input or Bus) before entering Sleep Mode.

**22-41 Minimum Sleep Time**

Range:	Function:
10 s* [0 - 600 s]	Set the desired Minimum Time for staying in Sleep Mode. This will override any wake up conditions.

22-42 Wake-up Speed [RPM]

Range:	Function:
0 RPM* [par. 4-11 - par. 4-13 RPM]	To be used if par. 0-02 <i>Motor Speed Unit</i> has been set for RPM (parameter not visible if Hz selected); Only to be used if par. 1-00 <i>Configuration Mode</i> is set for Open Loop and speed reference is applied by an external controller. Set the reference speed at which the Sleep Mode should be cancelled.

22-43 Wake-up Speed [Hz]

Range:	Function:
0 Hz* [par. 4-12 - par. 4-14 Hz]	To be used if par. 0-02 <i>Motor Speed Unit</i> , has been set for Hz (parameter not visible if RPM selected); Only to be used if par. 1-00 <i>Configuration Mode</i> , is set for Open Loop and speed reference is applied by an external controller controlling the pressure. Set the reference speed at which the Sleep Mode should be cancelled.

22-44 Wake-up Ref./FB Difference

Range:	Function:
10%* [0-100%]	Only to be used if par. 1-00, <i>Configuration Mode</i> , is set for Closed Loop and the integrated PI controller is used for controlling the pressure. Set the pressure drop allowed in percentage of set point for the pressure (Pset) before cancelling the Sleep Mode.

**NB!**

If used in application where the integrated PI controller is set for inverse control in par. 20-71, *PID, Normal/Inverse Control*, the value set in par. 22-44 will automatically be added.

22-45 Setpoint Boost

Range:	Function:
0 %* [-100 - 100 %]	Only to be used if par. 1-00 <i>Configuration Mode</i> , is set for Closed Loop and the integrated PI controller is used. In systems with e.g. constant pressure control, it is advantageous to increase the system pressure before the motor is stopped. This will extend the time in which the motor is stopped and help to avoid frequent start/stop. Set the desired over pressure/temperature in percentage of set point for the pressure (Pset)/temperature before entering the Sleep Mode. If setting for 5%, the boost pressure will be $Pset * 1.05$. The negative values can be used for e.g. cooling tower control where a negative change is needed.

22-46 Maximum Boost Time

Range:	Function:
60 s* [0 - 600 s]	Only to be used if par. 1-00 <i>Configuration Mode</i> is set for Closed Loop and the integrated PI controller is used for controlling the pressure. Set the maximum time for which boost mode will be allowed. If the set time is exceeded, Sleep Mode will be entered, not waiting for the set boost pressure to be reached.



22-50 End of Curve Function

Option:	Function:
[0] * Off	End of Curve monitoring not active.
[1] Warning	A warning is issued in the display [W94].
[2] Alarm	An alarm is issued and the frequency converter trips. A message [A94] appears in the display.



NB!
 Automatic restart will reset the alarm and start the system again.

22-51 End of Curve Delay

Range:	Function:
10 s* [0 - 600 s]	When an End of Curve condition is detected, a timer is activated. When the time set in this parameter expires, and the End of Curve condition has been steady in the entire period, the function set in par. 22-50 <i>End of Curve Function</i> will be activated. If the condition disappears before the timer expires, the timer will be reset.

22-80 Flow Compensation

Option:	Function:
[0] * Disabled	[0] <i>Disabled</i> : Set-Point compensation not active.
[1] Enabled	[1] <i>Enabled</i> : Set-Point compensation is active. Enabling this parameter allows the Flow Compensated Setpoint operation.

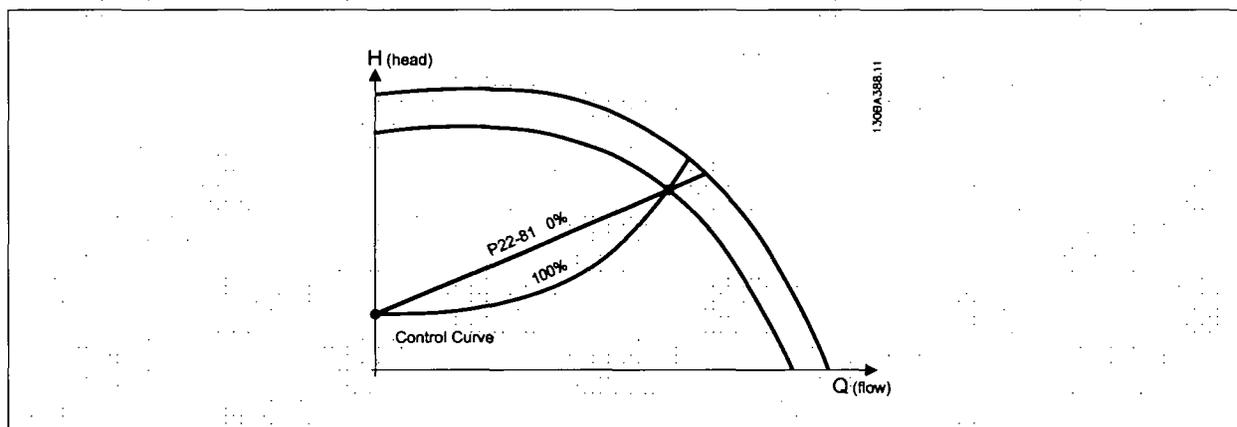
8

22-81 Square-linear Curve Approximation

Range:	Function:
100 %* [0 - 100 %]	Example 1: Adjustment of this parameter allows the shape of the control curve to be adjusted. 0 = Linear 100% = Ideal shape (theoretical).



NB!
 Please note: Not visible when running in cascade.



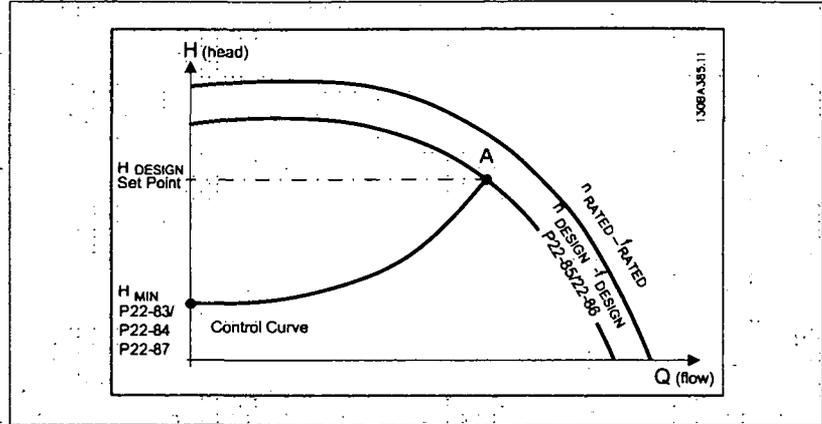


22-82 Work Point Calculation

Option:

Function:

Example 1: Speed at System Design Working Point is known:

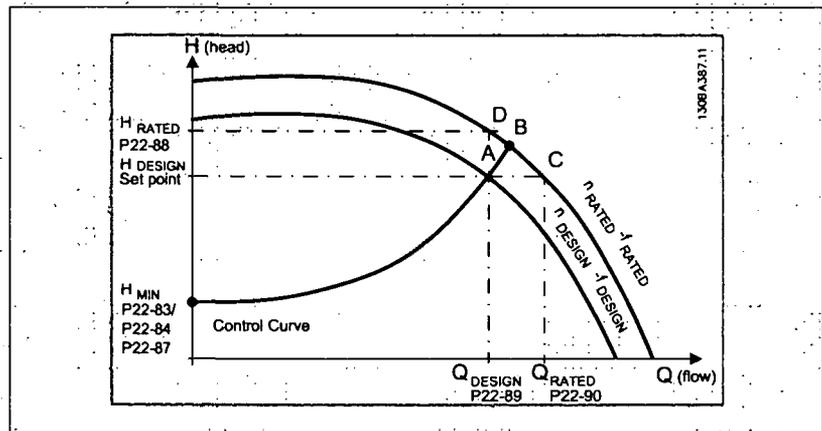


From the data sheet showing characteristics for the specific equipment at different speeds, simply reading across from the H_{DESIGN} point and the Q_{DESIGN} point allows us to find point A, which is the System Design Working Point. The pump characteristics at this point should be identified and the associated speed programmed. Closing the valves and adjusting the speed until H_{MIN} has been achieved allows the speed at the no flow point to be identified.

Adjustment of par. 22-81 *Square-linear Curve Approximation* then allows the shape of the control curve to be adjusted infinitely.

Example 2:

Speed at System Design Working Point is not known: Where the Speed at System Design Working Point is unknown, another reference point on the control curve needs to be determined by means of the data sheet. By looking at the curve for the rated speed and plotting the design pressure (H_{DESIGN} , Point C) the flow at that pressure Q_{RATED} can be determined. Similarly, by plotting the design flow (Q_{DESIGN} , Point D), the pressure H_D at that flow can be determined. Knowing these two points on the pump curve, along with H_{MIN} as described above, allows the frequency converter to calculate the reference point B and thus to plot the control curve which will also include the System design Working Point A.



[0] * Disabled

Disabled [0]: Work Point Calculation not active. To be used if speed at design point is known (see table above).

[1] Enabled

Enabled [1]: Work Point Calculation is active. Enabling this parameter allows the calculation of the unknown System Design Working Point at 50/60 Hz speed, from the input data set in par. 22-83 *Speed at No-Flow [RPM]* par. 22-84 *Speed at No-Flow [Hz]*, par. 22-87 *Pressure at No-Flow Speed*, par. 22-88 *Pressure at Rated Speed*, par. 22-89 *Flow at Design Point* and par. 22-90 *Flow at Rated Speed*.



22-83 Speed at No-Flow [RPM]

Range:	Function:
300. RPM* [0 - par. 22-85 RPM]	Resolution 1 RPM. The speed of the motor at which flow is zero and minimum pressure H_{MIN} is achieved should be entered here in RPM. Alternatively, the speed in Hz can be entered in par. 22-84 <i>Speed at No-Flow [Hz]</i> . If it has been decided to use RPM in par. 0-02 <i>Motor Speed Unit</i> then par. 22-85 <i>Speed at Design Point [RPM]</i> should also be used. Closing the valves and reducing the speed until minimum pressure H_{MIN} is achieved will determine this value.

22-84 Speed at No-Flow [Hz]

Range:	Function:
50.0 Hz* [0.0 - par. 22-86 Hz]	Resolution 0.033 Hz. The speed of the motor at which flow has effectively stopped and minimum pressure H_{MIN} is achieved should be entered here in Hz. Alternatively, the speed in RPM can be entered in par. 22-83 <i>Speed at No-Flow [RPM]</i> . If it has been decided to use Hz in par. 0-02 <i>Motor Speed Unit</i> then par. 22-86 <i>Speed at Design Point [Hz]</i> should also be used. Closing the valves and reducing the speed until minimum pressure H_{MIN} is achieved will determine this value.

22-85 Speed at Design Point [RPM]

Range:	Function:
1500. RPM* [par. 22-83 - 60000. RPM]	Resolution 1 RPM. Only visible when par. 22-82 <i>Work Point Calculation</i> is set to <i>Disable</i> . The speed of the motor at which the System Design Working Point is achieved should be entered here in RPM. Alternatively, the speed in Hz can be entered in par. 22-86 <i>Speed at Design Point [Hz]</i> . If it has been decided to use RPM in par. 0-02 <i>Motor Speed Unit</i> then par. 22-83 <i>Speed at No-Flow [RPM]</i> should also be used.

22-86 Speed at Design Point [Hz]

Range:	Function:
50/60.0 Hz* [par. 22-84 - par. 4-19 Hz]	Resolution 0.033 Hz. Only visible when par. 22-82 <i>Work Point Calculation</i> is set to <i>Disable</i> . The speed of the motor at which the System Design Working Point is achieved should be entered here in Hz. Alternatively, the speed in RPM can be entered in par. 22-85 <i>Speed at Design Point [RPM]</i> . If it has been decided to use Hz in par. 0-02 <i>Motor Speed Unit</i> , then par. 22-83 <i>Speed at No-Flow [RPM]</i> should also be used.

22-87 Pressure at No-Flow Speed

Range:	Function:
0.000 N/A* [0.000 - par. 22-88 N/A]	Enter the pressure H_{MIN} corresponding to Speed at No Flow in Reference/Feedback Units.

22-88 Pressure at Rated Speed

Range:	Function:
999999.999 N/A* [par. 22-87 - 999999.999 N/A]	Enter the value corresponding to the Pressure at Rated Speed, in Reference/Feedback Units. This value can be defined using the pump datasheet.

22-90 Flow at Rated Speed

Range:	Function:
0.000 N/A* [0.000 - 999999.999 N/A]	Enter the value corresponding to Flow at Rated Speed. This value can be defined using the pump datasheet.



8 How to Programme the Frequency Converter



8.2.11 23-0* Timed Actions

Use *Timed Actions* for actions needing to be performed on a daily or weekly basis, e.g. different references for working hours / non-working hours. Up to 10 Timed Actions can be programmed in the frequency converter. The Timed Action number is selected from the list when entering parameter group 23-0* from the LCP. par. 23-00 *ON Time* – par. 23-04 *Occurrence* then refer to the selected Timed Action number. Each Timed Action is divided into an ON time and an OFF time, in which two different actions may be performed.

The actions programmed in Timed Actions are merged with corresponding actions from digital inputs, control work via bus and Smart Logic Controller, according to merge rules set up in 8-5*, Digital/Bus.



NB!

The clock (parameter group 0-7*) must be correctly programmed for Timed Actions to function correctly.



NB!

When mounting an Analog I/O MCB109 option card, a battery back up of the date and time is included.

NB!

The PC-based Configuration Tool MCT 10 comprise a special guide for easy programming of Timed Actions.

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23-00 ON Time

Array [10]

Range:

0 N/A* ... [0 - 0 N/A]

Function:

Sets the ON time for the Timed Action.



NB!

The frequency converter has no back up of the clock function and the set date/time will reset to default (2000-01-01 00:00) after a power down unless a Real Time Clock module with back up is installed. In par. 0-79 *Clock Fault* it is possible to program for a Warning in case clock has not been set properly, e.g. after a power down.

23-01 ON Action

Arra [10]

Option:

Function:

Select the action during ON Time. See par. 13-52 *SL Controller Action* for descriptions of the options.

[0] * Disabled

[1] No action

[2] Select set-up 1

[3] Select set-up 2

[4] Select set-up 3

[5] Select set-up 4

[10] Select preset ref 0

[11] Select preset ref 1

[12] Select preset ref 2

[13] Select preset ref 3

[14] Select preset ref 4

[15] Select preset ref 5



- [16] Select preset ref 6
- [17] Select preset ref 7
- [18] Select ramp 1
- [19] Select ramp 2
- [22] Run
- [23] Run reverse
- [24] Stop
- [26] DC Brake
- [27] Coast
- [28] Freeze output
- [29] Start timer 0
- [30] Start timer 1
- [31] Start timer 2
- [32] Set digital out A low
- [33] Set digital out B low
- [34] Set digital out C low
- [35] Set digital out D low
- [36] Set digital out E low
- [37] Set digital out F low
- [38] Set digital out A high
- [39] Set digital out B high
- [40] Set digital out C high
- [41] Set digital out D high
- [42] Set digital out E high
- [43] Set digital out F high
- [60] Reset Counter A
- [61] Reset Counter B
- [70] Start Timer 3
- [71] Start Timer 4
- [72] Start Timer 5
- [73] Start Timer 6
- [74] Start Timer 7

NB!
 For choices [32] - [43], see also par. group 5-3*, *Digital Outputs* and 5-4*, *Relays*.

23-02 OFF Time

Array [10]

Range:

0 N/A* [0 - 0 N/A]

Function:

Sets the OFF time for the Timed Action.



NB!
 The frequency converter has no back up of the dock function and the set date/time will reset to default (2000-01-01 00:00) after a power down unless a Real Time Clock module with back up is installed. In par. 0-79 *Clock Fault* it is possible to program for a Warning in case clock has not been set properly, e.g. after a power down.



23-03 OFF Action

Array [10]

Option:

Function:

Select the action during OFF Time. See par. 13-52 *SL Controller Action* for descriptions of the options.

[0] *	Disabled
[1]	No action
[2]	Select set-up 1
[3]	Select set-up 2
[4]	Select set-up 3
[5]	Select set-up 4
[10]	Select preset ref 0
[11]	Select preset ref 1
[12]	Select preset ref 2
[13]	Select preset ref 3
[14]	Select preset ref 4
[15]	Select preset ref 5
[16]	Select preset ref 6
[17]	Select preset ref 7
[18]	Select ramp 1
[19]	Select ramp 2
[22]	Run
[23]	Run reverse
[24]	Stop
[26]	DC Brake
[27]	Coast
[28]	Freeze output
[29]	Start timer 0
[30]	Start timer 1
[31]	Start timer 2
[32]	Set digital out A low
[33]	Set digital out B low
[34]	Set digital out C low
[35]	Set digital out D low
[36]	Set digital out E low
[37]	Set digital out F low
[38]	Set digital out A high
[39]	Set digital out B high
[40]	Set digital out C high
[41]	Set digital out D high
[42]	Set digital out E high
[43]	Set digital out F high
[60]	Reset Counter A
[61]	Reset Counter B
[70]	Start Timer 3
[71]	Start Timer 4
[72]	Start Timer 5

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[73] Start Timer 6

[74] Start Timer 7

23-04 Occurrence

Array [10]

Option:

Function:

Select which day(s) the Timed Action applies to. Specify working/non-working days in par. 0-81 *Working Days*, par. 0-82 *Additional Working Days* and par. 0-83 *Additional Non-Working Days*.

[0] * All days

[1] Working days

[2] Non-working days

[3] Monday

[4] Tuesday

[5] Wednesday

[6] Thursday

[7] Friday

[8] Saturday

[9] Sunday

8.2.12 Water Application Functions, 29-**

The group contains parameters used for monitoring water / wastewater applications.

29-00 Pipe Fill Enable

Option:

Function:

[0] * Disabled

Select Enabled to fill pipes at a user specified rate.

[1] Enabled

Select Enabled to fill pipes with a user specified rate.

29-01 Pipe Fill Speed [RPM]

Range:

Function:

Speed Low [Speed Low Limit - Speed High Lim-
Limit* it]

Set the filling speed for filling horizontal pipe systems. The speed can be selected in Hz or RPM depending on the choices made in par. 4-11 / par. 4-13 (RPM) or in par. 4-12 / par. 4-14 (Hz).

29-02 Pipe Fill Speed [Hz]

Range:

Function:

Motor [Speed Low Limit - Speed High Lim-
Speed Low it]
Limit*

Set the filling speed for filling horizontal pipe systems. The speed can be selected in Hz or RPM depending on the choices made in par. 4-11 / par. 4-13 (RPM) or in par. 4-12 / par. 4-14 (Hz).

29-03 Pipe Fill Time

Range:

Function:

0 s* [0 - 3600 s]

Set the specified time for pipe filling of horizontal pipe systems.

29-04 Pipe Fill Rate

Range:

Function:

0.001 units/ s* [0.001 – 999999.999 units/s]

Specifies the filling rate in units/second using the PI controller. Filling rate units are feedback units/second. This function is used for filling-up vertical pipe systems but will be active when the filling-time has expired, no matter what, until the pipe fill-set-point set in par. 29-05 is reached.

**29-05 Filled Setpoint****Range:**

0 s* [0 – 999999,999 s]

Function:

Specifies the Filled Set-point at which the Pipe Fill Function will be disabled and the PID controller will take control. This function can be used both for horizontal and vertical pipe systems.



8.3 Parameter Options

8.3.1 Default settings

Changes during operation:

"TRUE" means that the parameter can be changed while the frequency converter is in operation and "FALSE" means that the frequency converter must be stopped before a change can be made.

4-Set-up:

'All set-up': the parameter can be set individually in each of the four set-ups, i. e. one single parameter can have four different data values.

'1 set-up': data value will be the same in all set-ups.

SR:

Size related

N/A:

No default value available.

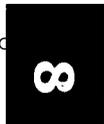
Conversion index:

This number refers to a conversion figure used when writing or reading by means of a frequency converter.

Conv. index	100	67	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6
Conv. factor	1	1/60	1000000	100000	10000	1000	100	10	1	0.1	0.01	0.001	0.0001	0.00001	0.000001

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	UInt8
6	Unsigned 16	UInt16
7	Unsigned 32	UInt32
9	Visible String	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD





8.3.2 Operation/Display 0-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
0-0* Basic Settings						
0-01	Language	[0] English	1 set-up	TRUE	-	Uint8
0-02	Motor Speed Unit	[0] RPM	2 set-ups	FALSE	-	Uint8
0-03	Regional Settings	[0] International	2 set-ups	FALSE	-	Uint8
0-04	Operating State at Power-up	[0] Resume	All set-ups	TRUE	-	Uint8
0-05	Local Mode Unit	[0] As Motor Speed Unit	2 set-ups	FALSE	-	Uint8
0-1* Set-up Operations						
0-10	Active Set-up	[1] Set-up 1	1 set-up	TRUE	-	Uint8
0-11	Programming Set-up	[9] Active Set-up	All set-ups	TRUE	-	Uint8
0-12	This Set-up Linked to	[0] Not linked	All set-ups	FALSE	-	Uint8
0-13	Readout: Linked Set-ups	0 N/A	All set-ups	FALSE	0	Uint16
0-14	Readout: Prog. Set-ups / Channel	0 N/A	All set-ups	TRUE	0	Int32
0-2* LCP Display						
0-20	Display Line 1.1 Small	1601	All set-ups	TRUE	-	Uint16
0-21	Display Line 1.2 Small	1662	All set-ups	TRUE	-	Uint16
0-22	Display Line 1.3 Small	1614	All set-ups	TRUE	-	Uint16
0-23	Display Line 2 Large	1613	All set-ups	TRUE	-	Uint16
0-24	Display Line 3 Large	1652	All set-ups	TRUE	-	Uint16
0-25	My Personal Menu	SR	1 set-up	TRUE	0	Uint16
0-3* LCP Custom Readout						
0-30	Custom Readout Unit	[1] %	All set-ups	TRUE	-	Uint8
0-31	Custom Readout Min Value	SR	All set-ups	TRUE	-2	Int32
0-32	Custom Readout Max Value	100.00 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
0-37	Display Text 1	0 N/A	1 set-up	TRUE	0	VisStr[25]
0-38	Display Text 2	0 N/A	1 set-up	TRUE	0	VisStr[25]
0-39	Display Text 3	0 N/A	1 set-up	TRUE	0	VisStr[25]
0-4* LCP Keypad						
0-40	[Hand on] Key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-41	[Off] Key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-42	[Auto on] Key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-43	[Reset] Key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-44	[Off/Reset] Key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-45	[Drive Bypass] Key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-5* Copy/Save						
0-50	LCP Copy	[0] No copy	All set-ups	FALSE	-	Uint8
0-51	Set-up Copy	[0] No copy	All set-ups	FALSE	-	Uint8

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
0-6* Password						
0-60	Main Menu Password	100 N/A	1 set-up	TRUE	0	UInt16
0-61	Access to Main Menu w/o Password	[0] Full access	1 set-up	TRUE	-	UInt8
0-65	Personal Menu Password	200 N/A	1 set-up	TRUE	0	UInt16
0-66	Access to Personal Menu w/o Password	[0] Full access	1 set-up	TRUE	-	UInt8
0-7* Clock Settings						
0-70	Date and Time	SR	All set-ups	TRUE	0	TimeOfDay
0-71	Date Format	[0] YYYY-MM-DD	1 set-up	TRUE	-	UInt8
0-72	Time Format	[0] 24 h	1 set-up	TRUE	-	UInt8
0-74	DST/Summertime	[0] Off	1 set-up	TRUE	-	UInt8
0-76	DST/Summertime Start	SR	1 set-up	TRUE	0	TimeOfDay
0-77	DST/Summertime End	SR	1 set-up	TRUE	0	TimeOfDay
0-79	Clock Fault	null	1 set-up	TRUE	-	UInt8
0-81	Working Days	null	1 set-up	TRUE	-	UInt8
0-82	Additional Working Days	SR	1 set-up	TRUE	0	TimeOfDay
0-83	Additional Non-Working Days	SR	1 set-up	TRUE	0	TimeOfDay
0-89	Date and Time Readout	0 N/A	All set-ups	TRUE	0	VisStr[25]

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8.3.3 Load/Motor 1-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
1-0* General Settings						
1-00	Configuration Mode	null	All set-ups	TRUE	-	Uint8
1-01	Motor Control Principle	null	All set-ups	FALSE	-	Uint8
1-03	Torque Characteristics	[3] Auto Energy Optim. VT	All set-ups	TRUE	-	Uint8
1-1* Motor Selection						
1-10	Motor Construction	[0] Asynchron	All set-ups	FALSE	-	Uint8
1-2* Motor Data						
1-20	Motor Power [kW]	SR	All set-ups	FALSE	1	Uint32
1-21	Motor Power [HP]	SR	All set-ups	FALSE	-2	Uint32
1-22	Motor Voltage	SR	All set-ups	FALSE	0	Uint16
1-23	Motor Frequency	SR	All set-ups	FALSE	0	Uint16
1-24	Motor Current	SR	All set-ups	FALSE	-2	Uint32
1-25	Motor Nominal Speed	SR	All set-ups	FALSE	67	Uint16
1-28	Motor Rotation Check	[0] Off	All set-ups	FALSE	-	Uint8
1-29	Automatic Motor Adaptation (AMA)	[0] Off	All set-ups	FALSE	-	Uint8
1-3* Adv. Motor Data						
1-30	Stator Resistance (Rs)	SR	All set-ups	FALSE	-4	Uint32
1-31	Rotor Resistance (Rr)	SR	All set-ups	FALSE	-4	Uint32
1-32	Stator Reactance (Xs)	SR	All set-ups	FALSE	-4	Uint32
1-33	Stator Leakage Reactance (X1)	SR	All set-ups	FALSE	-4	Uint32
1-34	Rotor Leakage Reactance (X2)	SR	All set-ups	FALSE	-4	Uint32
1-35	Main Reactance (Xh)	SR	All set-ups	FALSE	-4	Uint32
1-36	Iron Loss Resistance (Rfe)	SR	All set-ups	FALSE	-3	Uint32
1-39	Motor Poles	SR	All set-ups	FALSE	0	Uint8
1-5* Load Indep. Setting						
1-50	Motor Magnetisation at Zero Speed	100 %	All set-ups	TRUE	0	Uint16
1-51	Min Speed Normal Magnetising [RPM]	SR	All set-ups	TRUE	67	Uint16
1-52	Min Speed Normal Magnetising [Hz]	SR	All set-ups	TRUE	-1	Uint16
1-55	V/f Characteristic - V	SR	All set-ups	TRUE	-1	Uint16
1-56	V/f Characteristic - f	SR	All set-ups	TRUE	-1	Uint16
1-6* Load Depen. Setting						
1-60	Low Speed Load Compensation	100 %	All set-ups	TRUE	0	Int16
1-61	High Speed Load Compensation	100 %	All set-ups	TRUE	0	Int16
1-62	Slip Compensation	0 %	All set-ups	TRUE	0	Int16
1-63	Slip Compensation Time Constant	SR	All set-ups	TRUE	-2	Uint16
1-64	Resonance Dampening	100 %	All set-ups	TRUE	0	Uint16
1-65	Resonance Dampening Time Constant	5 ms	All set-ups	TRUE	-3	Uint8
1-7* Start Adjustments						
1-71	Start Delay	0.0 s	All set-ups	TRUE	-1	Uint16
1-73	Flying Start	[0] Disabled	All set-ups	FALSE	-	Uint8
1-74	Start Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
1-75	Start Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
1-76	Start Current	0.00 A	All set-ups	TRUE	-2	Uint32

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
1-8* Stop Adjustments						
1-80	Function at Stop	[0] Coast	All set-ups	TRUE	-	Uint8
1-81	Min Speed for Function at Stop [RPM]	SR	All set-ups	TRUE	67	Uint16
1-82	Min Speed for Function at Stop [Hz]	SR	All set-ups	TRUE	-1	Uint16
1-86	Trip Speed Low [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
1-87	Trip Speed Low [Hz]	0 Hz	All set-ups	TRUE	-1	Uint16
1-9* Motor Temperature						
1-90	Motor Thermal Protection	[4] ETR trip 1	All set-ups	TRUE	-	Uint8
1-91	Motor External Fan	[0] No	All set-ups	TRUE	-	Uint16
1-93	Thermistor Source	[0] None	All set-ups	TRUE	-	Uint8

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8.3.4 Brakes 2-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
2-0* DC-Brake						
2-00	DC Hold/Preheat Current	50 %	All set-ups	TRUE	0	Uint8
2-01	DC Brake Current	50 %	All set-ups	TRUE	0	Uint16
2-02	DC Braking Time	10.0 s	All set-ups	TRUE	-1	Uint16
2-03	DC Brake Cut In Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
2-04	DC Brake Cut In Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
2-1* Brake Energy Funct.						
2-10	Brake Function	[0] Off	All set-ups	TRUE	-	Uint8
2-11	Brake Resistor (ohm)	SR	All set-ups	TRUE	0	Uint16
2-12	Brake Power Limit (kW)	SR	All set-ups	TRUE	0	Uint32
2-13	Brake Power Monitoring	[0] Off	All set-ups	TRUE	-	Uint8
2-15	Brake Check	[0] Off	All set-ups	TRUE	-	Uint8
2-16	AC brake Max. Current	100.0 %	All set-ups	TRUE	-1	Uint32
2-17	Over-voltage Control	[2] Enabled	All set-ups	TRUE	-	Uint8

8.3.5 Reference / Ramps 3-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
3-0* Reference Limits						
3-02	Minimum Reference	SR	All set-ups	TRUE	-3	Int32
3-03	Maximum Reference	SR	All set-ups	TRUE	-3	Int32
3-04	Reference Function	[0] Sum	All set-ups	TRUE	-	UInt8
3-1* References						
3-10	Preset Reference	0.00 %	All set-ups	TRUE	-2	Int16
3-11	Jog Speed [Hz]	SR	All set-ups	TRUE	-1	UInt16
3-13	Reference Site	[0] Linked to Hand / Auto	All set-ups	TRUE	-	UInt8
3-14	Preset Relative Reference	0.00 %	All set-ups	TRUE	-2	Int32
3-15	Reference 1 Source	[1] Analog input 53	All set-ups	TRUE	-	UInt8
3-16	Reference 2 Source	[0] No function	All set-ups	TRUE	-	UInt8
3-17	Reference 3 Source	[0] No function	All set-ups	TRUE	-	UInt8
3-19	Jog Speed [RPM]	SR	All set-ups	TRUE	67	UInt16
3-4* Ramp 1						
3-41	Ramp 1 Ramp Up Time	SR	All set-ups	TRUE	-2	UInt32
3-42	Ramp 1 Ramp Down Time	SR	All set-ups	TRUE	-2	UInt32
3-5* Ramp 2						
3-51	Ramp 2 Ramp Up Time	SR	All set-ups	TRUE	-2	UInt32
3-52	Ramp 2 Ramp Down Time	SR	All set-ups	TRUE	-2	UInt32
3-8* Other Ramps						
3-80	Jog Ramp Time	SR	All set-ups	TRUE	-2	UInt32
3-81	Quick Stop Ramp Time	SR	2 set-ups	TRUE	-2	UInt32
3-84	Initial Ramp Time	0.00 s	All set-ups	TRUE	-2	UInt16
3-85	Check Valve Ramp Time	0.00 s	All set-ups	TRUE	-2	UInt16
3-86	Check Valve Ramp End Speed [RPM]	SR	All set-ups	TRUE	67	UInt16
3-87	Check Valve Ramp End Speed [HZ]	SR	All set-ups	TRUE	-1	UInt16
3-88	Final Ramp Time	0.00 s	All set-ups	TRUE	-2	UInt16
3-9* Digital Pot. Meter						
3-90	Step Size	0.10 %	All set-ups	TRUE	-2	UInt16
3-91	Ramp Time	1.00 s	All set-ups	TRUE	-2	UInt32
3-92	Power Restore	[0] Off	All set-ups	TRUE	-	UInt8
3-93	Maximum Limit	100 %	All set-ups	TRUE	0	Int16
3-94	Minimum Limit	0 %	All set-ups	TRUE	0	Int16
3-95	Ramp Delay	SR	All set-ups	TRUE	-3	TimD

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8.3.6 Limits / Warnings 4-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
4-1* Motor Limits						
4-10	Motor Speed Direction	[0] Clockwise	All set-ups	FALSE	-	Uint8
4-11	Motor Speed Low Limit [RPM]	SR	All set-ups	TRUE	67	Uint16
4-12	Motor Speed Low Limit [Hz]	SR	All set-ups	TRUE	-1	Uint16
4-13	Motor Speed High Limit [RPM]	SR	All set-ups	TRUE	67	Uint16
4-14	Motor Speed High Limit [Hz]	SR	All set-ups	TRUE	-1	Uint16
4-16	Torque Limit Motor Mode	SR	All set-ups	TRUE	-1	Uint16
4-17	Torque Limit Generator Mode	100.0 %	All set-ups	TRUE	-1	Uint16
4-18	Current Limit	SR	All set-ups	TRUE	-1	Uint32
4-19	Max Output Frequency	SR	All set-ups	FALSE	-1	Uint16
4-5* Adj. Warnings						
4-50	Warning Current Low	0.00 A	All set-ups	TRUE	-2	Uint32
4-51	Warning Current High	ImaxVLIT (P1637)	All set-ups	TRUE	-2	Uint32
4-52	Warning Speed Low	0 RPM	All set-ups	TRUE	67	Uint16
4-53	Warning Speed High	outputSpeedHighLimit (P413)	All set-ups	TRUE	67	Uint16
4-54	Warning Reference Low	-999999.999 N/A	All set-ups	TRUE	-3	Int32
4-55	Warning Reference High	999999.999 N/A	All set-ups	TRUE	-3	Int32
4-56	Warning Feedback Low	-999999.999 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
4-57	Warning Feedback High	999999.999 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
4-58	Missing Motor Phase Function	[2] Trip 1000 ms	All set-ups	TRUE	-	Uint8
4-6* Speed Bypass						
4-60	Bypass Speed From [RPM]	SR	All set-ups	TRUE	67	Uint16
4-61	Bypass Speed From [Hz]	SR	All set-ups	TRUE	-1	Uint16
4-62	Bypass Speed To [RPM]	SR	All set-ups	TRUE	67	Uint16
4-63	Bypass Speed To [Hz]	SR	All set-ups	TRUE	-1	Uint16
4-64	Semi-Auto Bypass Set-up	[0] Off	All set-ups	FALSE	-	Uint8



8.3.7 Digital In/Out 5-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
5-0* Digital I/O mode						
5-00	Digital I/O Mode	[0] PNP - Active at 24V	All set-ups	FALSE	-	Uint8
5-01	Terminal 27 Mode	[0] Input	All set-ups	TRUE	-	Uint8
5-02	Terminal 29 Mode	[0] Input	All set-ups	TRUE	-	Uint8
5-1* Digital Inputs						
5-10	Terminal 18 Digital Input	[8] Start	All set-ups	TRUE	-	Uint8
5-11	Terminal 19 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-12	Terminal 27 Digital Input	null	All set-ups	TRUE	-	Uint8
5-13	Terminal 29 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-14	Terminal 32 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-15	Terminal 33 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-16	Terminal X30/2 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-17	Terminal X30/3 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-18	Terminal X30/4 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-3* Digital Outputs						
5-30	Terminal 27 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
5-31	Terminal 29 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
5-32	Term X30/6 Digi Out (MCB 101)	[0] No operation	All set-ups	TRUE	-	Uint8
5-33	Term X30/7 Digi Out (MCB 101)	[0] No operation	All set-ups	TRUE	-	Uint8
5-4* Relays						
5-40	Function Relay	null	All set-ups	TRUE	-	Uint8
5-41	On Delay, Relay	0.01 s	All set-ups	TRUE	-2	Uint16
5-42	Off Delay, Relay	0.01 s	All set-ups	TRUE	-2	Uint16
5-5* Pulse Input						
5-50	Term. 29 Low Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-51	Term. 29 High Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-52	Term. 29 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
5-53	Term. 29 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
5-54	Pulse Filter Time Constant #29	100 ms	All set-ups	FALSE	-3	Uint16
5-55	Term. 33 Low Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-56	Term. 33 High Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-57	Term. 33 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
5-58	Term. 33 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
5-59	Pulse Filter Time Constant #33	100 ms	All set-ups	FALSE	-3	Uint16
5-6* Pulse Output						
5-60	Terminal 27 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8
5-62	Pulse Output Max Freq #27	5000 Hz	All set-ups	TRUE	0	Uint32
5-63	Terminal 29 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8
5-65	Pulse Output Max Freq #29	5000 Hz	All set-ups	TRUE	0	Uint32
5-66	Terminal X30/6 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8
5-68	Pulse Output Max Freq #X30/6	5000 Hz	All set-ups	TRUE	0	Uint32
5-9* Bus Controlled						
5-90	Digital & Relay Bus Control	0 N/A	All set-ups	TRUE	0	Uint32
5-93	Pulse Out #27 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
5-94	Pulse Out #27 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
5-95	Pulse Out #29 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
5-96	Pulse Out #29 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
5-97	Pulse Out #X30/6 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
5-98	Pulse Out #X30/6 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

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8.3.8 Analog In/Out 6-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
6-0* Analog I/O Mode						
6-00	Live Zero Timeout Time	10 s	All set-ups	TRUE	0	Uint8
6-01	Live Zero Timeout Function	[0] Off	All set-ups	TRUE	-	Uint8
6-1* Analog Input 53						
6-10	Terminal 53 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-11	Terminal 53 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-12	Terminal 53 Low Current	4.00 mA	All set-ups	TRUE	-5	Int16
6-13	Terminal 53 High Current	20.00 mA	All set-ups	TRUE	-5	Int16
6-14	Terminal 53 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
6-15	Terminal 53 High Ref./Feedb. Value	SR	All set-ups	TRUE	-3	Int32
6-16	Terminal 53 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-17	Terminal 53 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
6-2* Analog Input 54						
6-20	Terminal 54 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-21	Terminal 54 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-22	Terminal 54 Low Current	4.00 mA	All set-ups	TRUE	-5	Int16
6-23	Terminal 54 High Current	20.00 mA	All set-ups	TRUE	-5	Int16
6-24	Terminal 54 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
6-25	Terminal 54 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
6-26	Terminal 54 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-27	Terminal 54 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
6-3* Analog Input X30/11						
6-30	Terminal X30/11 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-31	Terminal X30/11 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-34	Term. X30/11 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
6-35	Term. X30/11 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
6-36	Term. X30/11 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-37	Term. X30/11 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
6-4* Analog Input X30/12						
6-40	Terminal X30/12 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-41	Terminal X30/12 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-44	Term. X30/12 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
6-45	Term. X30/12 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
6-46	Term. X30/12 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-47	Term. X30/12 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
6-5* Analog Output 42						
6-50	Terminal 42 Output	[100] Output freq. 0-100	All set-ups	TRUE	-	Uint8
6-51	Terminal 42 Output Min Scale	0.00 %	All set-ups	TRUE	-2	Int16
6-52	Terminal 42 Output Max Scale	100.00 %	All set-ups	TRUE	-2	Int16
6-53	Terminal 42 Output Bus Control	0.00 %	All set-ups	TRUE	-2	N2
6-54	Terminal 42 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
6-6* Analog Output X30/8						
6-60	Terminal X30/8 Output	[0] No operation	All set-ups	TRUE	-	Uint8
6-61	Terminal X30/8 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
6-62	Terminal X30/8 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
6-63	Terminal X30/8 Output Bus Control	0.00 %	All set-ups	TRUE	-2	N2
6-64	Terminal X30/8 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

8.3.9 Comm. and Options 8-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
8-0* General Settings						
8-01	Control Site	null	All set-ups	TRUE	-	UInt8
8-02	Control Source	null	All set-ups	TRUE	-	UInt8
8-03	Control Timeout Time	SR	1 set-up	TRUE	-1	UInt32
8-04	Control Timeout Function	[0] Off	1 set-up	TRUE	-	UInt8
8-05	End-of-Timeout Function	[1] Resume set-up	1 set-up	TRUE	-	UInt8
8-06	Reset Control Timeout	[0] Do not reset	All set-ups	TRUE	-	UInt8
8-07	Diagnosis Trigger	[0] Disable	2 set-ups	TRUE	-	UInt8
8-1* Control Settings						
8-10	Control Profile	[0] FC profile	All set-ups	TRUE	-	UInt8
8-13	Configurable Status Word STW	[1] Profile Default	All set-ups	TRUE	-	UInt8
8-14	Configurable Control Word CTW	[1] Profile default	All set-ups	TRUE	-	UInt8
8-3* FC Port Settings						
8-30	Protocol	null	1 set-up	TRUE	-	UInt8
8-31	Address	SR	1 set-up	TRUE	0	UInt8
8-32	Baud Rate	null	1 set-up	TRUE	-	UInt8
8-33	Parity / Stop Bits	null	1 set-up	TRUE	-	UInt8
8-35	Minimum Response Delay	SR	1 set-up	TRUE	-3	UInt16
8-36	Max Response Delay	SR	1 set-up	TRUE	-3	UInt16
8-37	Maximum Inter-Char Delay	SR	1 set-up	TRUE	-5	UInt16
8-4* FC MC protocol set						
8-40	Telegram Selection	[1] Standard telegram 1	2 set-ups	TRUE	-	UInt8
8-5* Digital/Bus						
8-50	Coasting Select	[3] Logic OR	All set-ups	TRUE	-	UInt8
8-52	DC Brake Select	[3] Logic OR	All set-ups	TRUE	-	UInt8
8-53	Start Select	[3] Logic OR	All set-ups	TRUE	-	UInt8
8-54	Reversing Select	null	All set-ups	TRUE	-	UInt8
8-55	Set-up Select	[3] Logic OR	All set-ups	TRUE	-	UInt8
8-56	Preset Reference Select	[3] Logic OR	All set-ups	TRUE	-	UInt8
8-7* BACnet						
8-70	BACnet Device Instance	1 N/A	1 set-up	TRUE	0	UInt32
8-72	MS/TP Max Masters	127 N/A	1 set-up	TRUE	0	UInt8
8-73	MS/TP Max Info Frames	1 N/A	1 set-up	TRUE	0	UInt16
8-74	"I-Am" Service	[0] Send at power-up	1 set-up	TRUE	-	UInt8
8-75	Initialisation Password	SR	1 set-up	TRUE	0	VisStr[20]
8-8* FC Port Diagnostics						
8-80	Bus Message Count	0 N/A	All set-ups	TRUE	0	UInt32
8-81	Bus Error Count	0 N/A	All set-ups	TRUE	0	UInt32
8-82	Slave Message Rcvd	0 N/A	All set-ups	TRUE	0	UInt32
8-83	Slave Error Count	0 N/A	All set-ups	TRUE	0	UInt32
8-9* Bus Jog / Feedback						
8-90	Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	67	UInt16
8-91	Bus Jog 2 Speed	200 RPM	All set-ups	TRUE	67	UInt16
8-94	Bus Feedback 1	0 N/A	1 set-up	TRUE	0	N2
8-95	Bus Feedback 2	0 N/A	1 set-up	TRUE	0	N2
8-96	Bus Feedback 3	0 N/A	1 set-up	TRUE	0	N2

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8.3.10 Profibus 9-**

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
9-00	Setpoint	0 N/A	All set-ups		TRUE	0	Uint16
9-07	Actual Value	0 N/A	All set-ups		FALSE	0	Uint16
9-15	PCD Write Configuration	ExpressionLimit	2 set-ups		TRUE	-	Uint16
9-16	PCD Read Configuration	ExpressionLimit	2 set-ups		TRUE	-	Uint16
9-18	Node Address	126 N/A	1 set-up		TRUE	0	Uint8
9-22	Telegram Selection	[108] PPO 8	1 set-up		TRUE	-	Uint8
9-23	Parameters for Signals	0	All set-ups		TRUE	-	Uint16
9-27	Parameter Edit	[1] Enabled	2 set-ups		FALSE	-	Uint16
9-28	Process Control	[1] Enable cyclic master	2 set-ups		FALSE	-	Uint8
9-44	Fault Message Counter	0 N/A	All set-ups		TRUE	0	Uint16
9-45	Fault Code	0 N/A	All set-ups		TRUE	0	Uint16
9-47	Fault Number	0 N/A	All set-ups		TRUE	0	Uint16
9-52	Fault Situation Counter	0 N/A	All set-ups		TRUE	0	Uint16
9-53	Profibus Warning Word	0 N/A	All set-ups		TRUE	0	V2
9-63	Actual Baud Rate	[255] No baudrate found	All set-ups		TRUE	-	Uint8
9-64	Device Identification	0 N/A	All set-ups		TRUE	0	Uint16
9-65	Profile Number	0 N/A	All set-ups		TRUE	0	OctStr[2]
9-67	Control Word 1	0 N/A	All set-ups		TRUE	0	V2
9-68	Status Word 1	0 N/A	All set-ups		TRUE	0	V2
9-71	Profibus Save Data Values	[0] Off	All set-ups		TRUE	-	Uint8
9-72	ProfibusDriveReset	[0] No action	1 set-up		FALSE	-	Uint8
9-80	Defined Parameters (1)	0 N/A	All set-ups		FALSE	0	Uint16
9-81	Defined Parameters (2)	0 N/A	All set-ups		FALSE	0	Uint16
9-82	Defined Parameters (3)	0 N/A	All set-ups		FALSE	0	Uint16
9-83	Defined Parameters (4)	0 N/A	All set-ups		FALSE	0	Uint16
9-84	Defined Parameters (5)	0 N/A	All set-ups		FALSE	0	Uint16
9-90	Changed Parameters (1)	0 N/A	All set-ups		FALSE	0	Uint16
9-91	Changed Parameters (2)	0 N/A	All set-ups		FALSE	0	Uint16
9-92	Changed Parameters (3)	0 N/A	All set-ups		FALSE	0	Uint16
9-93	Changed Parameters (4)	0 N/A	All set-ups		FALSE	0	Uint16
9-94	Changed Parameters (5)	0 N/A	All set-ups		FALSE	0	Uint16

8.3.11 CAN Fieldbus 10-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
10-0* Common Settings						
10-00	CAN Protocol	null	2 set-ups	FALSE	-	Uint8
10-01	Baud Rate Select	null	2 set-ups	TRUE	-	Uint8
10-02	MAC ID	SR	2 set-ups	TRUE	0	Uint8
10-05	Readout Transmit Error Counter	0 N/A	All set-ups	TRUE	0	Uint8
10-06	Readout Receive Error Counter	0 N/A	All set-ups	TRUE	0	Uint8
10-07	Readout Bus Off Counter	0 N/A	All set-ups	TRUE	0	Uint8
10-1* DeviceNet						
10-10	Process Data Type Selection	null	All set-ups	TRUE	-	Uint8
10-11	Process Data Config Write	SR	2 set-ups	TRUE	-	Uint16
10-12	Process Data Config Read	SR	2 set-ups	TRUE	-	Uint16
10-13	Warning Parameter	0 N/A	All set-ups	TRUE	0	Uint16
10-14	Net Reference	[0] Off	2 set-ups	TRUE	-	Uint8
10-15	Net Control	[0] Off	2 set-ups	TRUE	-	Uint8
10-2* COS Filters						
10-20	COS Filter 1	0 N/A	All set-ups	FALSE	0	Uint16
10-21	COS Filter 2	0 N/A	All set-ups	FALSE	0	Uint16
10-22	COS Filter 3	0 N/A	All set-ups	FALSE	0	Uint16
10-23	COS Filter 4	0 N/A	All set-ups	FALSE	0	Uint16
10-3* Parameter Access						
10-30	Array Index	0 N/A	2 set-ups	TRUE	0	Uint8
10-31	Store Data Values	[0] Off	All set-ups	TRUE	-	Uint8
10-32	DeviceNet Revision	SR	All set-ups	TRUE	0	Uint16
10-33	Store Always	[0] Off	1 set-up	TRUE	-	Uint8
10-34	DeviceNet Product Code	130 N/A	1 set-up	TRUE	0	Uint16
10-39	DeviceNet F Parameters	0 N/A	All set-ups	TRUE	0	Uint32

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8.3.12 Smart Logic 13-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
13-0* SLC Settings						
13-00	SL Controller Mode	null	2 set-ups	TRUE	-	UInt8
13-01	Start Event	null	2 set-ups	TRUE	-	UInt8
13-02	Stop Event	null	2 set-ups	TRUE	-	UInt8
13-03	Reset SLC	[0] Do not reset SLC	All set-ups	TRUE	-	UInt8
13-1* Comparators						
13-10	Comparator Operand	null	2 set-ups	TRUE	-	UInt8
13-11	Comparator Operator	null	2 set-ups	TRUE	-	UInt8
13-12	Comparator Value	SR	2 set-ups	TRUE	-3	Int32
13-2* Timers						
13-20	SL Controller Timer	SR	1 set-up	TRUE	-3	TimD
13-4* Logic Rules						
13-40	Logic Rule Boolean 1	null	2 set-ups	TRUE	-	UInt8
13-41	Logic Rule Operator 1	null	2 set-ups	TRUE	-	UInt8
13-42	Logic Rule Boolean 2	null	2 set-ups	TRUE	-	UInt8
13-43	Logic Rule Operator 2	null	2 set-ups	TRUE	-	UInt8
13-44	Logic Rule Boolean 3	null	2 set-ups	TRUE	-	UInt8
13-5* States						
13-51	SL Controller Event	null	2 set-ups	TRUE	-	UInt8
13-52	SL Controller Action	null	2 set-ups	TRUE	-	UInt8

8.3.13 Special Functions 14-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
14-0* Inverter Switching						
14-00	Switching Pattern	null	All set-ups	TRUE	-	Uint8
14-01	Switching Frequency	null	All set-ups	TRUE	-	Uint8
14-03	Overmodulation	[1] On	All set-ups	FALSE	-	Uint8
14-04	PWM Random	[0] Off	All set-ups	TRUE	-	Uint8
14-1* Mains On/Off						
14-10	Mains Failure	[0] No function	All set-ups	FALSE	-	Uint8
14-11	Mains Voltage at Mains Fault	SR	All set-ups	TRUE	0	Uint16
14-12	Function at Mains Imbalance	[3] Derate	All set-ups	TRUE	-	Uint8
14-2* Reset Functions						
14-20	Reset Mode	[10] Automatic reset x 10	All set-ups	TRUE	-	Uint8
14-21	Automatic Restart Time	10 s	All set-ups	TRUE	0	Uint16
14-22	Operation Mode	[0] Normal operation	All set-ups	TRUE	-	Uint8
14-23	Typecode Setting	null	2 set-ups	FALSE	-	Uint8
14-25	Trip Delay at Torque Limit	60 s	All set-ups	TRUE	0	Uint8
14-26	Trip Delay at Inverter Fault	SR	All set-ups	TRUE	0	Uint8
14-28	Production Settings	[0] No action	All set-ups	TRUE	-	Uint8
14-29	Service Code	0 N/A	All set-ups	TRUE	0	Int32
14-3* Current Limit Ctrl.						
14-30	Current Lim Ctrl, Proportional Gain	100 %	All set-ups	FALSE	0	Uint16
14-31	Current Lim Ctrl, Integration Time	0.020 s	All set-ups	FALSE	-3	Uint16
14-32	Current Lim Ctrl, Filter Time	27.0 ms	All set-ups	FALSE	-4	Uint16
14-4* Energy Optimising						
14-40	VT Level	66 %	All set-ups	FALSE	0	Uint8
14-41	AEO Minimum Magnetisation	SR	All set-ups	TRUE	0	Uint8
14-42	Minimum AEO Frequency	10 Hz	All set-ups	TRUE	0	Uint8
14-43	Motor Cosphi	SR	All set-ups	TRUE	-2	Uint16
14-5* Environment						
14-50	RFI Filter	[1] On	1 set-up	FALSE	-	Uint8
14-52	Fan Control	[0] Auto	All set-ups	TRUE	-	Uint8
14-53	Fan Monitor	[1] Warning	All set-ups	TRUE	-	Uint8
14-55	Output Filter	[0] No Filter	1 set-up	FALSE	-	Uint8
14-59	Actual Number of Inverter Units	SR	1 set-up	FALSE	0	Uint8
14-6* Auto Derate						
14-60	Function at Over Temperature	[1] Derate	All set-ups	TRUE	-	Uint8
14-61	Function at Inverter Overload	[1] Derate	All set-ups	TRUE	-	Uint8
14-62	Inv. Overload Derate Current	95 %	All set-ups	TRUE	0	Uint16
14-8* Options						
14-80	Option Supplied by External 24VDC	[0] No	2 set-ups	FALSE	-	Uint8

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8.3.14 FC Information 15-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
15-0* Operating Data						
15-00	Operating Hours	0 h	All set-ups	FALSE	74	Uint32
15-01	Running Hours	0 h	All set-ups	FALSE	74	Uint32
15-02	kWh Counter	0 kWh	All set-ups	FALSE	75	Uint32
15-03	Power Up's	0 N/A	All set-ups	FALSE	0	Uint32
15-04	Over Temp's	0 N/A	All set-ups	FALSE	0	Uint16
15-05	Over Volt's	0 N/A	All set-ups	FALSE	0	Uint16
15-06	Reset kWh Counter	[0] Do not reset	All set-ups	TRUE	-	Uint8
15-07	Reset Running Hours Counter	[0] Do not reset	All set-ups	TRUE	-	Uint8
15-08	Number of Starts	0 N/A	All set-ups	FALSE	0	Uint32
15-1* Data Log Settings						
15-10	Logging Source	0	2 set-ups	TRUE	-	Uint16
15-11	Logging Interval	SR	2 set-ups	TRUE	-3	TimD
15-12	Trigger Event	[0] False	1 set-up	TRUE	-	Uint8
15-13	Logging Mode	[0] Log always	2 set-ups	TRUE	-	Uint8
15-14	Samples Before Trigger	50 N/A	2 set-ups	TRUE	0	Uint8
15-2* Historic Log						
15-20	Historic Log: Event	0 N/A	All set-ups	FALSE	0	Uint8
15-21	Historic Log: Value	0 N/A	All set-ups	FALSE	0	Uint32
15-22	Historic Log: Time	0 ms	All set-ups	FALSE	-3	Uint32
15-23	Historic Log: Date and Time	SR	All set-ups	FALSE	0	TimeOfDay
15-3* Alarm Log						
15-30	Alarm Log: Error Code	0 N/A	All set-ups	FALSE	0	Uint16
15-31	Alarm Log: Value	0 N/A	All set-ups	FALSE	0	Int16
15-32	Alarm Log: Time	0 s	All set-ups	FALSE	0	Uint32
15-33	Alarm Log: Date and Time	SR	All set-ups	FALSE	0	TimeOfDay
15-34	Alarm Log: Setpoint	0.000 ProcessCtrlUnit	All set-ups	FALSE	-3	Int32
15-35	Alarm Log: Feedback	0.000 ProcessCtrlUnit	All set-ups	FALSE	-3	Int32
15-36	Alarm Log: Current Demand	0 %	All set-ups	FALSE	0	Uint8
15-37	Alarm Log: Process Ctrl Unit	[0]	All set-ups	FALSE	-	Uint8
15-4* Drive Identification						
15-40	FC Type	0 N/A	All set-ups	FALSE	0	VisStr[6]
15-41	Power Section	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-42	Voltage	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-43	Software Version	0 N/A	All set-ups	FALSE	0	VisStr[5]
15-44	Ordered Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-45	Actual Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-46	Frequency Converter Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-47	Power Card Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-48	LCP Id No	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-49	SW ID Control Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-50	SW ID Power Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-51	Frequency Converter Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[10]
15-53	Power Card Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[19]

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Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
15-6* Option Ident						
15-60	Option Mounted	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-61	Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-62	Option Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-63	Option Serial No	0 N/A	All set-ups	FALSE	0	VisStr[18]
15-70	Option in Slot A	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-71	Slot A Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-72	Option in Slot B	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-73	Slot B Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-74	Option in Slot C0	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-75	Slot C0 Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-76	Option in Slot C1	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-77	Slot C1 Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-9* Parameter Info						
15-92	Defined Parameters	0 N/A	All set-ups	FALSE	0	Uint16
15-93	Modified Parameters	0 N/A	All set-ups	FALSE	0	Uint16
15-98	Drive Identification	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-99	Parameter Metadata	0 N/A	All set-ups	FALSE	0	Uint16

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8.3.15 Data Readouts 16-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
16-0* General Status						
16-00	Control Word	0 N/A	All set-ups	TRUE	0	V2
16-01	Reference [Unit]	0.000 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
16-02	Reference [%]	0.0 %	All set-ups	TRUE	-1	Int16
16-03	Status Word	0 N/A	All set-ups	TRUE	0	V2
16-05	Main Actual Value [%]	0.00 %	All set-ups	TRUE	-2	N2
16-09	Custom Readout	0.00 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
16-1* Motor Status						
16-10	Power [kW]	0.00 kW	All set-ups	TRUE	1	Int32
16-11	Power [hp]	0.00 hp	All set-ups	TRUE	-2	Int32
16-12	Motor Voltage	0.0 V	All set-ups	TRUE	-1	UInt16
16-13	Frequency	0.0 Hz	All set-ups	TRUE	-1	UInt16
16-14	Motor Current	0.00 A	All set-ups	TRUE	-2	Int32
16-15	Frequency [%]	0.00 %	All set-ups	TRUE	-2	N2
16-16	Torque [Nm]	0.0 Nm	All set-ups	TRUE	-1	Int32
16-17	Speed [RPM]	0 RPM	All set-ups	TRUE	67	Int32
16-18	Motor Thermal	0 %	All set-ups	TRUE	0	UInt8
16-22	Torque [%]	0 %	All set-ups	TRUE	0	Int16
16-3* Drive Status						
16-30	DC Link Voltage	0 V	All set-ups	TRUE	0	UInt16
16-32	Brake Energy /s	0.000 kW	All set-ups	TRUE	0	UInt32
16-33	Brake Energy /2 min	0.000 kW	All set-ups	TRUE	0	UInt32
16-34	Heatsink Temp.	0 °C	All set-ups	TRUE	100	UInt8
16-35	Inverter Thermal	0 %	All set-ups	TRUE	0	UInt8
16-36	Inv. Nom. Current	SR	All set-ups	TRUE	-2	UInt32
16-37	Inv. Max. Current	SR	All set-ups	TRUE	-2	UInt32
16-38	SL Controller State	0 N/A	All set-ups	TRUE	0	UInt8
16-39	Control Card Temp.	0 °C	All set-ups	TRUE	100	UInt8
16-40	Logging Buffer Full	[0] No	All set-ups	TRUE	-	UInt8
16-5* Ref. & Feedb.						
16-50	External Reference	0.0 N/A	All set-ups	TRUE	-1	Int16
16-52	Feedback [Unit]	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-53	Digi_Pot Reference	0.00 N/A	All set-ups	TRUE	-2	Int16
16-54	Feedback 1 [Unit]	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-55	Feedback 2 [Unit]	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-56	Feedback 3 [Unit]	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-58	PID Output [%]	0.0 %	All set-ups	TRUE	-1	Int16
16-59	Adjusted Setpoint	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32

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Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
16-6* Inputs & Outputs						
16-60	Digital Input	0 N/A	All set-ups	TRUE	0	UInt16
16-61	Terminal 53 Switch Setting	[0] Current	All set-ups	TRUE	-	UInt8
16-62	Analog Input 53	0.000 N/A	All set-ups	TRUE	-3	Int32
16-63	Terminal 54 Switch Setting	[0] Current	All set-ups	TRUE	-	UInt8
16-64	Analog Input 54	0.000 N/A	All set-ups	TRUE	-3	Int32
16-65	Analog Output 42 [mA]	0.000 N/A	All set-ups	TRUE	-3	Int16
16-66	Digital Output [bin]	0 N/A	All set-ups	TRUE	0	Int16
16-67	Pulse Input #29 [Hz]	0 N/A	All set-ups	TRUE	0	Int32
16-68	Pulse Input #33 [Hz]	0 N/A	All set-ups	TRUE	0	Int32
16-69	Pulse Output #27 [Hz]	0 N/A	All set-ups	TRUE	0	Int32
16-70	Pulse Output #29 [Hz]	0 N/A	All set-ups	TRUE	0	Int32
16-71	Relay Output [bin]	0 N/A	All set-ups	TRUE	0	UInt16
16-72	Counter A	0 N/A	All set-ups	TRUE	0	Int32
16-73	Counter B	0 N/A	All set-ups	TRUE	0	Int32
16-75	Analog In X30/11	0.000 N/A	All set-ups	TRUE	-3	Int32
16-76	Analog In X30/12	0.000 N/A	All set-ups	TRUE	-3	Int32
16-77	Analog Out X30/8 [mA]	0.000 N/A	All set-ups	TRUE	-3	Int16
16-8* Fieldbus & FC Port						
16-80	Fieldbus CTW 1	0 N/A	All set-ups	TRUE	0	V2
16-82	Fieldbus REF 1	0 N/A	All set-ups	TRUE	0	N2
16-84	Comm. Option STW	0 N/A	All set-ups	TRUE	0	V2
16-85	FC Port CTW 1	0 N/A	All set-ups	TRUE	0	V2
16-86	FC Port REF 1	0 N/A	All set-ups	TRUE	0	N2
16-9* Diagnosis Readouts						
16-90	Alarm Word	0 N/A	All set-ups	TRUE	0	UInt32
16-91	Alarm Word 2	0 N/A	All set-ups	TRUE	0	UInt32
16-92	Warning Word	0 N/A	All set-ups	TRUE	0	UInt32
16-93	Warning Word 2	0 N/A	All set-ups	TRUE	0	UInt32
16-94	Ext. Status Word	0 N/A	All set-ups	TRUE	0	UInt32
16-95	Ext. Status Word 2	0 N/A	All set-ups	TRUE	0	UInt32
16-96	Maintenance Word	0 N/A	All set-ups	TRUE	0	UInt32

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8.3.16 Data Readouts 2 18-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
18-0* Maintenance Log						
18-00	Maintenance Log: Item	0 N/A	All set-ups	FALSE	0	Uint8
18-01	Maintenance Log: Action	0 N/A	All set-ups	FALSE	0	Uint8
18-02	Maintenance Log: Time	0 s	All set-ups	FALSE	0	Uint32
18-03	Maintenance Log: Date and Time	SR	All set-ups	FALSE	0	TimeOfDay
18-3* Inputs & Outputs						
18-30	Analog Input X42/1	0.000 N/A	All set-ups	FALSE	-3	Int32
18-31	Analog Input X42/3	0.000 N/A	All set-ups	FALSE	-3	Int32
18-32	Analog Input X42/5	0.000 N/A	All set-ups	FALSE	-3	Int32
18-33	Analog Out X42/7 [V]	0.000 N/A	All set-ups	FALSE	-3	Int16
18-34	Analog Out X42/9 [V]	0.000 N/A	All set-ups	FALSE	-3	Int16
18-35	Analog Out X42/11 [V]	0.000 N/A	All set-ups	FALSE	-3	Int16

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8.3.17 FC Closed Loop 20-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
20-0* Feedback						
20-00	Feedback 1 Source	[2] Analog input 54	All set-ups	TRUE	-	Uint8
20-01	Feedback 1 Conversion	[0] Linear	All set-ups	FALSE	-	Uint8
20-02	Feedback 1 Source Unit	null	All set-ups	TRUE	-	Uint8
20-03	Feedback 2 Source	[0] No function	All set-ups	TRUE	-	Uint8
20-04	Feedback 2 Conversion	[0] Linear	All set-ups	FALSE	-	Uint8
20-05	Feedback 2 Source Unit	null	All set-ups	TRUE	-	Uint8
20-06	Feedback 3 Source	[0] No function	All set-ups	TRUE	-	Uint8
20-07	Feedback 3 Conversion	[0] Linear	All set-ups	FALSE	-	Uint8
20-08	Feedback 3 Source Unit	null	All set-ups	TRUE	-	Uint8
20-12	Reference/Feedback Unit	null	All set-ups	TRUE	-	Uint8
20-2* Feedback/Setpoint						
20-20	Feedback Function	[4] Maximum	All set-ups	TRUE	-	Uint8
20-21	Setpoint 1	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
20-22	Setpoint 2	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
20-23	Setpoint 3	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
20-7* PID Autotuning						
20-70	Closed Loop Type	[0] Auto	2 set-ups	TRUE	-	Uint8
20-71	PID Performance	[0] Normal	2 set-ups	TRUE	-	Uint8
20-72	PID Output Change	0.10 N/A	2 set-ups	TRUE	-2	Uint16
20-73	Minimum Feedback Level	-999999.000 ProcessCtrlUnit	2 set-ups	TRUE	-3	Int32
20-74	Maximum Feedback Level	999999.000 ProcessCtrlUnit	2 set-ups	TRUE	-3	Int32
20-79	PID Autotuning	[0] Disabled	All set-ups	TRUE	-	Uint8
20-8* PID Basic Settings						
20-81	PID Normal/ Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
20-82	PID Start Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
20-83	PID Start Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
20-84	On Reference Bandwidth	5 %	All set-ups	TRUE	0	Uint8
20-9* PID Controller						
20-91	PID Anti Windup	[1] On	All set-ups	TRUE	-	Uint8
20-93	PID Proportional Gain	2.00 N/A	All set-ups	TRUE	-2	Uint16
20-94	PID Integral Time	8.00 s	All set-ups	TRUE	-2	Uint32
20-95	PID Differentiation Time	0.00 s	All set-ups	TRUE	-2	Uint16
20-96	PID Diff. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16

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8.3.18 Ext. Closed Loop 21-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
21-0* Ext. CL Autotuning						
21-00	Closed Loop Type	[0] Auto	2 set-ups	TRUE	-	Uint8
21-01	PID Performance	[0] Normal	2 set-ups	TRUE	-	Uint8
21-02	PID Output Change	0.10 N/A	2 set-ups	TRUE	-2	Uint16
21-03	Minimum Feedback Level	-999999.000 N/A	2 set-ups	TRUE	-3	Int32
21-04	Maximum Feedback Level	999999.000 N/A	2 set-ups	TRUE	-3	Int32
21-09	PID Auto Tuning	[0] Disabled	All set-ups	TRUE	-	Uint8
21-1* Ext. CL 1 Ref./Fb.						
21-10	Ext. 1 Ref./Feedback Unit	[0]	All set-ups	TRUE	-	Uint8
21-11	Ext. 1 Minimum Reference	0.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-12	Ext. 1 Maximum Reference	100.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-13	Ext. 1 Reference Source	[0] No function	All set-ups	TRUE	-	Uint8
21-14	Ext. 1 Feedback Source	[0] No function	All set-ups	TRUE	-	Uint8
21-15	Ext. 1 Setpoint	0.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-17	Ext. 1 Reference [Unit]	0.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-18	Ext. 1 Feedback [Unit]	0.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-19	Ext. 1 Output [%]	0 %	All set-ups	TRUE	0	Int32
21-2* Ext. CL 1 PID						
21-20	Ext. 1 Normal/Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
21-21	Ext. 1 Proportional Gain	0.50 N/A	All set-ups	TRUE	-2	Uint16
21-22	Ext. 1 Integral Time	20.00 s	All set-ups	TRUE	-2	Int32
21-23	Ext. 1 Differentiation Time	0.00 s	All set-ups	TRUE	-2	Int32
21-24	Ext. 1 Dif. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16
21-3* Ext. CL 2 Ref./Fb.						
21-30	Ext. 2 Ref./Feedback Unit	[0]	All set-ups	TRUE	-	Uint8
21-31	Ext. 2 Minimum Reference	0.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-32	Ext. 2 Maximum Reference	100.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-33	Ext. 2 Reference Source	[0] No function	All set-ups	TRUE	-	Uint8
21-34	Ext. 2 Feedback Source	[0] No function	All set-ups	TRUE	-	Uint8
21-35	Ext. 2 Setpoint	0.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-37	Ext. 2 Reference [Unit]	0.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-38	Ext. 2 Feedback [Unit]	0.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-39	Ext. 2 Output [%]	0 %	All set-ups	TRUE	0	Int32
21-4* Ext. CL 2 PID						
21-40	Ext. 2 Normal/Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
21-41	Ext. 2 Proportional Gain	0.50 N/A	All set-ups	TRUE	-2	Uint16
21-42	Ext. 2 Integral Time	20.00 s	All set-ups	TRUE	-2	Int32
21-43	Ext. 2 Differentiation Time	0.00 s	All set-ups	TRUE	-2	Int32
21-44	Ext. 2 Dif. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
21-5* Ext. CL 3 Ref./Fb.						
21-50	Ext. 3 Ref./Feedback Unit	[0]	All set-ups	TRUE	-	Uint8
21-51	Ext. 3 Minimum Reference	0.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-52	Ext. 3 Maximum Reference	100.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-53	Ext. 3 Reference Source	[0] No function	All set-ups	TRUE	-	Uint8
21-54	Ext. 3 Feedback Source	[0] No function	All set-ups	TRUE	-	Uint8
21-55	Ext. 3 Setpoint	0.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-57	Ext. 3 Reference [Unit]	0.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-58	Ext. 3 Feedback [Unit]	0.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-59	Ext. 3 Output [%]	0 %	All set-ups	TRUE	0	Int32
21-6* Ext. CL 3 PID						
21-60	Ext. 3 Normal/Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
21-61	Ext. 3 Proportional Gain	0.50 N/A	All set-ups	TRUE	-2	Uint16
21-62	Ext. 3 Integral Time	20.00 s	All set-ups	TRUE	-2	Uint32
21-63	Ext. 3 Differentiation Time	0.00 s	All set-ups	TRUE	-2	Uint16
21-64	Ext. 3 Dif. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16

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8.3.19 Application Functions 22-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
22-0* Miscellaneous						
22-00	External Interlock Delay	0 s	All set-ups	TRUE	0	Uint16
22-2* No-Flow Detection						
22-20	Low Power Auto Set-up	[0] Off	All set-ups	FALSE	-	Uint8
22-21	Low Power Detection	[0] Disabled	All set-ups	TRUE	-	Uint8
22-22	Low Speed Detection	[0] Disabled	All set-ups	TRUE	-	Uint8
22-23	No-Flow Function	[0] Off	All set-ups	TRUE	-	Uint8
22-24	No-Flow Delay	10 s	All set-ups	TRUE	0	Uint16
22-26	Dry Pump Function	[0] Off	All set-ups	TRUE	-	Uint8
22-27	Dry Pump Delay	10 s	All set-ups	TRUE	0	Uint16
22-28	No-Flow Low Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
22-29	No-Flow Low Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
22-3* No-Flow Power Tuning						
22-30	No-Flow Power	0.00 kW	All set-ups	TRUE	1	Uint32
22-31	Power Correction Factor	100 %	All set-ups	TRUE	0	Uint16
22-32	Low Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
22-33	Low Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
22-34	Low Speed Power [kW]	SR	All set-ups	TRUE	1	Uint32
22-35	Low Speed Power [HP]	SR	All set-ups	TRUE	-2	Uint32
22-36	High Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
22-37	High Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
22-38	High Speed Power [kW]	SR	All set-ups	TRUE	1	Uint32
22-39	High Speed Power [HP]	SR	All set-ups	TRUE	-2	Uint32
22-4* Sleep Mode						
22-40	Minimum Run Time	60 s	All set-ups	TRUE	0	Uint16
22-41	Minimum Sleep Time	30 s	All set-ups	TRUE	0	Uint16
22-42	Wake-up Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
22-43	Wake-up Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
22-44	Wake-up Ref./FB Difference	10 %	All set-ups	TRUE	0	Int8
22-45	Setpoint Boost	0 %	All set-ups	TRUE	0	Int8
22-46	Maximum Boost Time	60 s	All set-ups	TRUE	0	Uint16
22-5* End of Curve						
22-50	End of Curve Function	[0] Off	All set-ups	TRUE	-	Uint8
22-51	End of Curve Delay	10 s	All set-ups	TRUE	0	Uint16
22-6* Broken Belt Detection						
22-60	Broken Belt Function	[0] Off	All set-ups	TRUE	-	Uint8
22-61	Broken Belt Torque	10 %	All set-ups	TRUE	0	Uint8
22-62	Broken Belt Delay	10 s	All set-ups	TRUE	0	Uint16
22-7* Short Cycle Protection						
22-75	Short Cycle Protection	[0] Disabled	All set-ups	TRUE	-	Uint8
22-76	Interval between Starts	start_to_start_min_on_time(P2277)	All set-ups	TRUE	0	Uint16
22-77	Minimum Run Time	0 s	All set-ups	TRUE	0	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
22-8* Flow Compensation						
22-80	Flow Compensation	[0] Disabled	All set-ups	TRUE	-	Uint8
22-81	Square-linear Curve Approximation	100 %	All set-ups	TRUE	0	Uint8
22-82	Work Point Calculation	[0] Disabled	All set-ups	TRUE	-	Uint8
22-83	Speed at No-Flow [RPM]	SR	All set-ups	TRUE	67	Uint16
22-84	Speed at No-Flow [Hz]	SR	All set-ups	TRUE	-1	Uint16
22-85	Speed at Design Point [RPM]	SR	All set-ups	TRUE	67	Uint16
22-86	Speed at Design Point [Hz]	SR	All set-ups	TRUE	-1	Uint16
22-87	Pressure at No-Flow Speed	0.000 N/A	All set-ups	TRUE	-3	Int32
22-88	Pressure at Rated Speed	999999.999 N/A	All set-ups	TRUE	-3	Int32
22-89	Flow at Design Point	0.000 N/A	All set-ups	TRUE	-3	Int32
22-90	Flow at Rated Speed	0.000 N/A	All set-ups	TRUE	-3	Int32



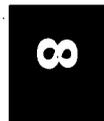
8.3.20 Timed Actions 23-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
23-0* Timed Actions						
23-00	ON Time	SR	2 set-ups	TRUE	0	TimeOfDay-WoDate
23-01	ON Action	[0] Disabled	2 set-ups	TRUE	-	UInt8
23-02	OFF Time	SR	2 set-ups	TRUE	0	TimeOfDay-WoDate
23-03	OFF Action	[0] Disabled	2 set-ups	TRUE	-	UInt8
23-04	Occurrence	[0] All days	2 set-ups	TRUE	-	UInt8
23-1* Maintenance						
23-10	Maintenance Item	[1] Motor bearings	1 set-up	TRUE	-	UInt8
23-11	Maintenance Action	[1] Lubricate	1 set-up	TRUE	-	UInt8
23-12	Maintenance Time Base	[0] Disabled	1 set-up	TRUE	-	UInt8
23-13	Maintenance Time Interval	1 h	1 set-up	TRUE	74	UInt32
23-14	Maintenance Date and Time	SR	1 set-up	TRUE	0	TimeOfDay
23-1* Maintenance Reset						
23-15	Reset Maintenance Word	[0] Do not reset	All set-ups	TRUE	-	UInt8
23-16	Maintenance Text	0 N/A	1 set-up	TRUE	0	VisStr[20]
23-5* Energy Log						
23-50	Energy Log Resolution	[5] Last 24 Hours	2 set-ups	TRUE	-	UInt8
23-51	Period Start	SR	2 set-ups	TRUE	0	TimeOfDay
23-53	Energy Log	0 N/A	All set-ups	TRUE	0	UInt32
23-54	Reset Energy Log	[0] Do not reset	All set-ups	TRUE	-	UInt8
23-6* Trending						
23-60	Trend Variable	[0] Power [kW]	2 set-ups	TRUE	-	UInt8
23-61	Continuous Bin Data	0 N/A	All set-ups	TRUE	0	UInt32
23-62	Timed Bin Data	0 N/A	All set-ups	TRUE	0	UInt32
23-63	Timed Period Start	SR	2 set-ups	TRUE	0	TimeOfDay
23-64	Timed Period Stop	SR	2 set-ups	TRUE	0	TimeOfDay
23-65	Minimum Bin Value	SR	2 set-ups	TRUE	0	UInt8
23-66	Reset Continuous Bin Data	[0] Do not reset	All set-ups	TRUE	-	UInt8
23-67	Reset Timed Bin Data	[0] Do not reset	All set-ups	TRUE	-	UInt8
23-8* Payback Counter						
23-80	Power Reference Factor	100 %	2 set-ups	TRUE	0	UInt8
23-81	Energy Cost	1.00 N/A	2 set-ups	TRUE	-2	UInt32
23-82	Investment	0 N/A	2 set-ups	TRUE	0	UInt32
23-83	Energy Savings	0 kWh	All set-ups	TRUE	75	Int32
23-84	Cost Savings	0 N/A	All set-ups	TRUE	0	Int32

8.3.21 Cascade Controller 25-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
25-0* System Settings						
25-00	Cascade Controller	null	2 set-ups	FALSE	-	UInt8
25-02	Motor Start	[0] Direct on Line	2 set-ups	FALSE	-	UInt8
25-04	Pump Cycling	null	All set-ups	TRUE	-	UInt8
25-05	Fixed Lead Pump	null	2 set-ups	FALSE	-	UInt8
25-06	Number of Pumps	2 N/A	2 set-ups	FALSE	0	UInt8
25-2* Bandwidth Settings						
25-20	Staging Bandwidth	SR	All set-ups	TRUE	0	UInt8
25-21	Override Bandwidth	100 %	All set-ups	TRUE	0	UInt8
25-22	Fixed Speed Bandwidth	casco_staging_bandwidth (P2520)	All set-ups	TRUE	0	UInt8
25-23	SBW Staging Delay	15 s	All set-ups	TRUE	0	UInt16
25-24	SBW Destaging Delay	15 s	All set-ups	TRUE	0	UInt16
25-25	OBW Time	10 s	All set-ups	TRUE	0	UInt16
25-26	Destage At No-Flow	[0] Disabled	All set-ups	TRUE	-	UInt8
25-27	Stage Function	null	All set-ups	TRUE	-	UInt8
25-28	Stage Function Time	15 s	All set-ups	TRUE	0	UInt16
25-29	Destage Function	null	All set-ups	TRUE	-	UInt8
25-30	Destage Function Time	15 s	All set-ups	TRUE	0	UInt16
25-4* Staging Settings						
25-40	Ramp Down Delay	10.0 s	All set-ups	TRUE	-1	UInt16
25-41	Ramp Up Delay	2.0 s	All set-ups	TRUE	-1	UInt16
25-42	Staging Threshold	SR	All set-ups	TRUE	0	UInt8
25-43	Destaging Threshold	SR	All set-ups	TRUE	0	UInt8
25-44	Staging Speed [RPM]	0 RPM	All set-ups	TRUE	67	UInt16
25-45	Staging Speed [Hz]	0.0 Hz	All set-ups	TRUE	-1	UInt16
25-46	Destaging Speed [RPM]	0 RPM	All set-ups	TRUE	67	UInt16
25-47	Destaging Speed [Hz]	0.0 Hz	All set-ups	TRUE	-1	UInt16
25-5* Alternation Settings						
25-50	Lead Pump Alternation	null	All set-ups	TRUE	-	UInt8
25-51	Alternation Event	[0] External	All set-ups	TRUE	-	UInt8
25-52	Alternation Time Interval	24 h	All set-ups	TRUE	74	UInt16
25-53	Alternation Timer Value	0 N/A	All set-ups	TRUE	0	VisStr[7] TimeOfDay- WoDate
25-54	Alternation Predefined Time	SR	All set-ups	TRUE	0	UInt8
25-55	Alternate if Load < 50%	[1] Enabled	All set-ups	TRUE	-	UInt8
25-56	Staging Mode at Alternation	[0] Slow	All set-ups	TRUE	-	UInt8
25-58	Run Next Pump Delay	0.1 s	All set-ups	TRUE	-1	UInt16
25-59	Run on Mains Delay	0.5 s	All set-ups	TRUE	-1	UInt16

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Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
25-8* Status						
25-80	Cascade Status	0 N/A	All set-ups	TRUE	0	VisStr[25]
25-81	Pump Status	0 N/A	All set-ups	TRUE	0	VisStr[25]
25-82	Lead Pump	0 N/A	All set-ups	TRUE	0	Uint8
25-83	Relay Status	0 N/A	All set-ups	TRUE	0	VisStr[4]
25-84	Pump ON Time	0 h	All set-ups	TRUE	74	Uint32
25-85	Relay ON Time	0 h	All set-ups	TRUE	74	Uint32
25-86	Reset Relay Counters	[0] Do not reset	All set-ups	TRUE	-	Uint8
25-9* Service						
25-90	Pump Interlock	[0] Off	All set-ups	TRUE	-	Uint8
25-91	Manual Alternation	0 N/A	All set-ups	TRUE	0	Uint8

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8.3.22 Analog I/O Option MCB 109 26-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
26-0* Analog I/O Mode						
26-00	Terminal X42/1 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
26-01	Terminal X42/3 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
26-02	Terminal X42/5 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
26-1* Analog Input X42/1						
26-10	Terminal X42/1 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
26-11	Terminal X42/1 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
26-14	Term. X42/1 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
26-15	Term. X42/1 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
26-16	Term. X42/1 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
26-17	Term. X42/1 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
26-2* Analog Input X42/3						
26-20	Terminal X42/3 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
26-21	Terminal X42/3 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
26-24	Term. X42/3 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
26-25	Term. X42/3 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
26-26	Term. X42/3 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
26-27	Term. X42/3 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
26-3* Analog Input X42/5						
26-30	Terminal X42/5 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
26-31	Terminal X42/5 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
26-34	Term. X42/5 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
26-35	Term. X42/5 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
26-36	Term. X42/5 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
26-37	Term. X42/5 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
26-4* Analog Out X42/7						
26-40	Terminal X42/7 Output	[0] No operation	All set-ups	TRUE	-	Uint8
26-41	Terminal X42/7 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
26-42	Terminal X42/7 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
26-43	Terminal X42/7 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
26-44	Terminal X42/7 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
26-5* Analog Out X42/9						
26-50	Terminal X42/9 Output	[0] No operation	All set-ups	TRUE	-	Uint8
26-51	Terminal X42/9 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
26-52	Terminal X42/9 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
26-53	Terminal X42/9 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
26-54	Terminal X42/9 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
26-6* Analog Out X42/11						
26-60	Terminal X42/11 Output	[0] No operation	All set-ups	TRUE	-	Uint8
26-61	Terminal X42/11 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
26-62	Terminal X42/11 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
26-63	Terminal X42/11 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
26-64	Terminal X42/11 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

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8.3.23 Parameter Lists - Group 27-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
27-0* Control & Status						
27-01	Pump Status	[0] Ready	All set-ups	TRUE	-	Uint8
27-02	Manual Pump Control	[0] No Operation	2 set-ups	TRUE	-	Uint8
27-03	Current Runtime Hours	0 h	All set-ups	TRUE	74	Uint32
27-04	Pump Total Lifetime Hours	0 h	All set-ups	TRUE	74	Uint32
27-1* Configuration						
27-10	Cascade Controller	[0] Disabled	2 set-ups	FALSE	-	Uint8
27-11	Number Of Drives	1 N/A	2 set-ups	FALSE	0	Uint8
27-12	Number Of Pumps	SR	2 set-ups	FALSE	0	Uint8
27-14	Pump Capacity	100 %	2 set-ups	FALSE	0	Uint16
27-16	Runtime Balancing	[0] Balanced Priority 1	2 set-ups	TRUE	-	Uint8
27-17	Motor Starters	[0] Direct Online	2 set-ups	FALSE	-	Uint8
27-18	Spin Time for Unused Pumps	SR	All set-ups	TRUE	0	Uint16
27-19	Reset Current Runtime Hours	[0] Do not reset	All set-ups	TRUE	-	Uint8
27-2* Bandwidth Settings						
27-20	Normal Operating Range	SR	All set-ups	TRUE	0	Uint8
27-21	Override Limit	100 %	All set-ups	TRUE	0	Uint8
27-22	Fixed Speed Only Operating Range	SR	All set-ups	TRUE	0	Uint8
27-23	Staging Delay	15 s	All set-ups	TRUE	0	Uint16
27-24	Destaging Delay	15 s	All set-ups	TRUE	0	Uint16
27-25	Override Hold Time	10 s	All set-ups	TRUE	0	Uint16
27-27	Min Speed Destage Delay	SR	All set-ups	TRUE	0	Uint16
27-3* Staging Speed						
27-30	Auto Tune Staging Speeds	[1] Enabled	All set-ups	TRUE	-	Uint8
27-31	Stage On Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
27-32	Stage On Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
27-33	Stage Off Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
27-34	Stage Off Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
27-4* Staging Settings						
27-40	Auto Tune Staging Settings	[0] Disabled	All set-ups	TRUE	-	Uint8
27-41	Ramp Down Delay	10.0 s	All set-ups	TRUE	-1	Uint16
27-42	Ramp Up Delay	2.0 s	All set-ups	TRUE	-1	Uint16
27-43	Staging Threshold	SR	All set-ups	TRUE	0	Uint8
27-44	Destaging Threshold	SR	All set-ups	TRUE	0	Uint8
27-45	Staging Speed [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
27-46	Staging Speed [Hz]	0.0 Hz	All set-ups	TRUE	-1	Uint16
27-47	Destaging Speed [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
27-48	Destaging Speed [Hz]	0.0 Hz	All set-ups	TRUE	-1	Uint16

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Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
27-5* Alternate Settings						
27-50	Automatic Alternation	[0] Disabled	All set-ups	FALSE	-	UInt8
27-51	Alternation Event	null	All set-ups	TRUE	-	UInt8
27-52	Alternation Time Interval	0 min	All set-ups	TRUE	70	UInt16
27-53	Alternation Timer Value	0 min	All set-ups	TRUE	70	UInt16
27-54	Alternation At Time of Day	[0] Disabled	All set-ups	TRUE	-	UInt8
27-55	Alternation Predefined Time	SR	All set-ups	TRUE	0	TimeOfDayWoDate
27-56	Alternate Capacity is <	0 %	All set-ups	TRUE	0	UInt8
27-58	Run Next Pump Delay	0.1 s	All set-ups	TRUE	-1	UInt16
27-6* Digital Inputs						
27-60	Terminal X66/1 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
27-61	Terminal X66/3 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
27-62	Terminal X66/5 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
27-63	Terminal X66/7 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
27-64	Terminal X66/9 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
27-65	Terminal X66/11 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
27-66	Terminal X66/13 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
27-7* Connections						
27-70	Relay	[0] Standard Relay	2 set-ups	FALSE	-	UInt8
27-9* Readouts						
27-91	Cascade Reference	0.0 %	All set-ups	TRUE	-1	Int16
27-92	% Of Total Capacity	0 %	All set-ups	TRUE	0	UInt16
27-93	Cascade Option Status	[0] Disabled	All set-ups	TRUE	-	UInt8
27-94	Cascade System Status	0 N/A	All set-ups	TRUE	0	VisStr[25]

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8.3.24 Water Application Functions 29-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
29-0* Pipe Fill						
29-00	Pipe Fill Enable	[0] Disabled	2 set-ups	FALSE	-	Uint8
29-01	Pipe Fill Speed [RPM]	SR	All set-ups	TRUE	67	Uint16
29-02	Pipe Fill Speed [Hz]	SR	All set-ups	TRUE	-1	Uint16
29-03	Pipe Fill Time	0.00 s	All set-ups	TRUE	-2	Uint32
29-04	Pipe Fill Rate	0.001 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
29-05	Filled Setpoint	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32

8.3.25 Bypass Option 31-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
31-00	Bypass Mode	[0] Drive	All set-ups	TRUE	-	UInt8
31-01	Bypass Start Time Delay	30 s	All set-ups	TRUE	0	UInt16
31-02	Bypass Trip Time Delay	0 s	All set-ups	TRUE	0	UInt16
31-03	Test Mode Activation	[0] Disabled	All set-ups	TRUE	-	UInt8
31-10	Bypass Status Word	0 N/A	All set-ups	FALSE	0	V2
31-11	Bypass Running Hours	0 h	All set-ups	FALSE	74	UInt32
31-19	Remote Bypass Activation	[0] Disabled	2 set-ups	TRUE	-	UInt8

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9 Troubleshooting

9.1 Alarms and Warnings

A warning or an alarm is signalled by the relevant LED on the front of the frequency converter and indicated by a code on the display.

A warning remains active until its cause is no longer present. Under certain circumstances operation of the motor may still be continued. Warning messages may be critical, but are not necessarily so.

In the event of an alarm, the frequency converter will have tripped. Alarms must be reset to restart operation once their cause has been rectified.

This may be done in four ways:

1. By using the [RESET] control button on the LCP control panel.
2. Via a digital input with the "Reset" function.
3. Via serial communication/optional fieldbus.
4. By resetting automatically using the [Auto Reset] function, which is a default setting for VLT AQUA Drive. see par. 14-20 *Reset Mode* in VLT AQUA Drive Programming Guide



NB!

After a manual reset using the [RESET] button on the LCP, the [AUTO ON] or [HAND ON] button must be pressed to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip-locked (see also table on following page).

Alarms that are trip-locked offer additional protection, means that the mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter is no longer blocked and may be reset as described above once the cause has been rectified.

Alarms that are not trip-locked can also be reset using the automatic reset function in par. 14-20 *Reset Mode* (Warning: automatic wake-up is possible!)

If a warning and alarm is marked against a code in the table on the following page, this means that either a warning occurs before an alarm, or it can be specified whether it is a warning or an alarm that is to be displayed for a given fault.

This is possible, for instance, in par. 1-90 *Motor Thermal Protection*. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash on the frequency converter. Once the problem has been rectified, only the alarm continues flashing.



9 Troubleshooting

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		6-01
3	No motor	(X)			1-80
4	Mains phase loss	(X)	(X)	(X)	14-12
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC over voltage	X	X		
8	DC under voltage	X	X		
9	Inverter overloaded	X	X		
10	Motor ETR over temperature	(X)	(X)		1-90
11	Motor thermistor over temperature	(X)	(X)		1-90
12	Torque limit	X	X		
13	Over Current	X	X	X	
14	Earth fault	X	X	X	
15	Hardware mismatch		X	X	
16	Short Circuit		X	X	
17	Control word timeout	(X)	(X)		8-04
23	Internal Fan Fault	X			
24	External Fan Fault	X			14-53
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		2-13
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		2-15
29	Drive over temperature	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	4-58
31	Motor phase V missing	(X)	(X)	(X)	4-58
32	Motor phase W missing	(X)	(X)	(X)	4-58
33	Inrush fault		X	X	
34	Fieldbus communication fault	X	X		
35	Out of frequency range	X	X		
36	Mains failure	X	X		
37	Phase Imbalance	X	X		
39	Heatsink sensor		X	X	
40	Overload of Digital Output Terminal 27	(X)			5-00, 5-01
41	Overload of Digital Output Terminal 29	(X)			5-00, 5-02
42	Overload of Digital Output On X30/6	(X)			5-32
42	Overload of Digital Output On X30/7	(X)			5-33
46	Pwr. card supply		X	X	
47	24 V supply low	X	X	X	
48	1.8 V supply low		X	X	
49	Speed limit	X			
50	AMA calibration failed		X		
51	AMA check U _{nom} and I _{nom}		X		
52	AMA low I _{nom}		X		
53	AMA motor too big		X		
54	AMA motor too small		X		
55	AMA parameter out of range		X		
56	AMA interrupted by user		X		
57	AMA timeout		X		
58	AMA internal fault	X	X		
59	Current limit	X			
60	External Interlock	X			
62	Output Frequency at Maximum Limit	X			
64	Voltage Limit	X			
65	Control Board Over-temperature	X	X	X	
66	Heat sink Temperature Low	X			
67	Option Configuration has Changed		X		
68	Safe Stop Activated		X ¹⁾		
69	Pwr. Card Temp		X	X	
70	Illegal FC configuration			X	
71	PTC 1 Safe Stop	X	X ¹⁾		
72	Dangerous Failure			X ¹⁾	
73	Safe Stop Auto Restart				
76	Power Unit Setup	X			
79	Illegal PS config		X	X	
80	Drive Initialised to Default Value		X		
91	Analog input 54 wrong settings			X	
92	NoFlow	X	X		22-2*
93	Dry Pump	X	X		22-2*
94	End of Curve	X	X		22-5*
95	Broken Belt	X	X		22-6*
96	Start Delayed	X			22-7*
97	Stop Delayed	X			22-7*
98	Clock Fault	X			0-7*

Table 9.1: Alarm/Warning code list



No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
220	Overload Trip		X		
243	Brake IGBT	X	X		
244	Heatsink temp	X	X	X	
245	Heatsink sensor		X	X	
246	Pwr. card supply		X	X	
247	Pwr. card temp		X	X	
248	Illegal PS config		X	X	
250	New spare part			X	
251	New Type Code		X	X	

Table 9.2: Alarm/Warning code list

(X) Dependent on parameter

1) Can not be Auto reset via par. 14-20 *Reset Mode*

A trip is the action when an alarm has appeared. The trip will coast the motor and can be reset by pressing the reset button or make a reset by a digital input (Par. 5-1* [1]). The origin event that caused an alarm cannot damage the frequency converter or cause dangerous conditions. A trip lock is an action when an alarm occurs, which may cause damage to frequency converter or connected parts. A Trip Lock situation can only be reset by a power cycling.

LED indication	
Warning	yellow
Alarm	flashing red
Trip locked	yellow and red

Alarm Word and Extended Status Word					
Bit	Hex	Dec	Alarm Word	Warning Word	Extended Status Word
0	00000001	1	Brake Check	Brake Check	Ramping
1	00000002	2	Pwr. Card Temp	Pwr. Card Temp	AMA Running
2	00000004	4	Earth Fault	Earth Fault	Start CW/CCW
3	00000008	8	Ctrl. Card Temp	Ctrl. Card Temp	Slow Down
4	00000010	16	Ctrl. Word TO	Ctrl. Word TO	Catch Up
5	00000020	32	Over Current	Over Current	Feedback High
6	00000040	64	Torque Limit	Torque Limit	Feedback Low
7	00000080	128	Motor Th Over	Motor Th Over	Output Current High
8	00000100	256	Motor ETR Over	Motor ETR Over	Output Current Low
9	00000200	512	Inverter Overld.	Inverter Overld.	Output Freq High
10	00000400	1024	DC under Volt	DC under Volt	Output Freq Low
11	00000800	2048	DC over Volt	DC over Volt	Brake Check OK
12	00001000	4096	Short Circuit	DC Voltage Low	Braking Max
13	00002000	8192	Inrush Fault	DC Voltage High	Braking
14	00004000	16384	Mains ph. Loss	Mains ph. Loss	Out of Speed Range
15	00008000	32768	AMA Not OK	No Motor	OVC Active
16	00010000	65536	Live Zero Error	Live Zero Error	
17	00020000	131072	Internal Fault	10V Low	
18	00040000	262144	Brake Overload	Brake Overload	
19	00080000	524288	U phase Loss	Brake Resistor	
20	00100000	1048576	V phase Loss	Brake IGBT	
21	00200000	2097152	W phase Loss	Speed Limit	
22	00400000	4194304	Fieldbus Fault	Fieldbus Fault	
23	00800000	8388608	24 V Supply Low	24V Supply Low	
24	01000000	16777216	Mains Failure	Mains Failure	
25	02000000	33554432	1.8V Supply Low	Current Limit	
26	04000000	67108864	Brake Resistor	Low Temp	
27	08000000	134217728	Brake IGBT	Voltage Limit	
28	10000000	268435456	Option Change	Unused	
29	20000000	536870912	Drive Initialised	Unused	
30	40000000	1073741824	Safe Stop	Unused	

Table 9.3: Description of Alarm Word, Warning Word and Extended Status Word

The alarm words, warning words and extended status words can be read out via serial bus or optional fieldbus for diagnosis. See also par. 16-90 *Alarm Word*, par. 16-92 *Warning Word* and par. 16-94 *Ext. Status Word*.





9 Troubleshooting

9.1.1 Fault messages

WARNING 1, 10 Volts low:

The 10 V voltage from terminal 50 on the control card is below 10 V. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω.

WARNING/ALARM 2, Live zero error:

The signal on terminal 53 or 54 is less than 50% of the value set in par. 6-10 *Terminal 53 Low Voltage*, par. 6-12 *Terminal 53 Low Current*, par. 6-20 *Terminal 54 Low Voltage*, or par. 6-22 *Terminal 54 Low Current* respectively.

WARNING/ALARM 3, No motor:

No motor has been connected to the output of the frequency converter.

WARNING/ALARM 4, Mains phase loss:

A phase is missing on the supply side, or the mains voltage imbalance is too high.

This message also appears in case of a fault in the input rectifier on the frequency converter.

Check the supply voltage and supply currents to the frequency converter.

WARNING 5, DC link voltage high:

The intermediate circuit voltage (DC) is higher than the over-voltage limit of the control system. The frequency converter is still active.

WARNING 6, DC link voltage low:

The intermediate circuit voltage (DC) is below the undervoltage limit of the control system. The frequency converter is still active.

WARNING/ALARM 7, DC over voltage:

If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.

Possible corrections:

Select Over Voltage Control function in par. 2-17 *Over-voltage Control*

Connect a brake resistor

Extend the ramp time

Activate functions in par. 2-10 *Brake Function*

Increase par. 14-26 *Trip Delay at Inverter Fault*

Selecting OVC function will extend the ramp times.

Alarm/warning limits:			
Voltage Range	3 x 200-240 VAC [VDC]	3 x 380-500 VAC [VDC]	3 x 550-600 VAC [VDC]
Under voltage	185	373	532
Voltage warning low	205	410	585
Voltage warning high (w/o brake - w/ brake)	390/405	810/840	943/965
Over voltage	410	855	975

The voltages stated are the intermediate circuit voltage of the frequency converter with a tolerance of ± 5 %. The corresponding mains voltage is the intermediate circuit voltage (DC-link) divided by 1.35

WARNING/ALARM 8, DC under voltage:

If the intermediate circuit voltage (DC) drops below the "voltage warning low" limit (see table above), the frequency converter checks if 24 V backup supply is connected.

If no 24 V backup supply is connected, the frequency converter trips after a given time depending on the unit.

To check whether the supply voltage matches the frequency converter, see 3.1 *General Specifications*.

WARNING/ALARM 9, Inverter overloaded:

The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. You cannot reset the frequency converter until the counter is below 90%.

The fault is that the frequency converter is overloaded by more than nominal current for too long.

WARNING/ALARM 10, Motor ETR over temperature:

According to the electronic thermal protection (ETR), the motor is too hot. You can choose if you want the frequency converter to give a warning or an alarm when the counter reaches 100% in par. 1-90 *Motor Thermal Protection*. The fault is that the motor is overloaded by more than nominal current for too long. Check that the motor par. 1-24 *Motor Current* is set correctly.

WARNING/ALARM 11, Motor thermistor over temp:

The thermistor or the thermistor connection is disconnected. You can choose if you want the frequency converter to give a warning or an alarm in par. 1-90 *Motor Thermal Protection*. Check that the thermistor is connected correctly between terminal 53 or 54 (analog voltage input) and terminal 50 (+ 10 Volts supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50. If a KTY sensor is used, check for correct connection between terminal 54 and 55.

WARNING/ALARM 12, Torque limit:

The torque is higher than the value in par. 4-16 *Torque Limit Motor Mode* (in motor operation) or the torque is higher than the value in par. 4-17 *Torque Limit Generator Mode* (in regenerative operation).

WARNING/ALARM 13, Over Current:

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 sec., then the frequency converter trips and issues an alarm. Turn off the frequency converter and check if the motor shaft can be turned and if the motor size matches the frequency converter.

ALARM 14, Earth fault:

There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself. Turn off the frequency converter and remove the earth fault.

ALARM 15, In-complete hardware:

A fitted option is not handled by the present control board (hardware or software).

ALARM 16, Short-circuit:

There is short-circuiting in the motor or on the motor terminals. Turn off the frequency converter and remove the short-circuit.

WARNING/ALARM 17, Control word timeout:

There is no communication to the frequency converter.

The warning will only be active when par. 8-04 *Control Timeout Function* is NOT set to OFF.

If par. 8-04 *Control Timeout Function* is set to *Stop* and *Trip*, a warning appears and the frequency converter ramps down to zero speed, while giving an alarm.

par. 8-03 *Control Timeout Time* could possibly be increased.

9

WARNING 23, Internal fans:

External fans have failed due to defect hardware or fans not mounted.

WARNING 24, External fan fault:

The fan warning function is an extra protection function that checks if the fan is running / mounted. The fan warning can be disabled in par. 14-53 *Fan Monitor*, [0] Disabled.

WARNING 25, Brake resistor short-circuited:

The brake resistor is monitored during operation. If it short-circuits, the brake function is disconnected and the warning appears. The frequency converter still works, but without the brake function. Turn off the frequency converter and replace the brake resistor (see par. 2-15 *Brake Check*).

ALARM/WARNING 26, Brake resistor power limit:

The power transmitted to the brake resistor is calculated as a percentage, as a mean value over the last 120 s, on the basis of the resistance value of the brake resistor (par. 2-11 *Brake Resistor (ohm)*) and the intermediate circuit voltage. The warning is active when the dissipated braking power is higher than 90%. If *Trip [2]* has been selected in par. 2-13 *Brake Power Monitoring*, the frequency converter cuts out and issues this alarm, when the dissipated braking power is higher than 100%.

WARNING/ALARM 27, Brake chopper fault:

The brake transistor is monitored during operation and if it short-circuits, the brake function disconnects and the warning comes up. The frequency converter is still able to run, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.

Turn off the frequency converter and remove the brake resistor.

Warning: There is a risk of substantial power being transmitted to the brake resistor if the brake transistor is short-circuited.

ALARM/WARNING 28, Brake check failed:

Brake resistor fault: the brake resistor is not connected/working.

WARNING/ALARM 29, Drive over temperature:

If the enclosure is IP00 or IP20/Nema1 the cut-out temperature of the heat-sink is 90 °C. If IP54 is used, the cut-out temperature is 80 °C.

The fault could be:

- Ambient temperature too high
- Too long motor cable

ALARM 30, Motor phase U missing:

Motor phase U between the frequency converter and the motor is missing.

Turn off the frequency converter and check motor phase U.

ALARM 31, Motor phase V missing:

Motor phase V between the frequency converter and the motor is missing. Turn off the frequency converter and check motor phase V.

ALARM 32, Motor phase W missing:

Motor phase W between the frequency converter and the motor is missing.

Turn off the frequency converter and check motor phase W.

ALARM 33, Inrush fault:

Too many powerups have occurred within a short time period. See the chapter *General Specifications* for the allowed number of power-ups within one minute.

WARNING/ALARM 34, Fieldbus communication fault:

The fieldbus on the communication option card is not working.

WARNING/ALARM 35, Option Fault:

Option fault. Please contact your supplier.

WARNING/ALARM 36, Mains failure:

This warning/alarm is only active if the supply voltage to the frequency converter is lost and parameter 14-10 is NOT set to OFF. Possible correction: check the fuses to the frequency converter

WARNING/ALARM 37, Phase Imbalance:

There is a current imbalance between the power units.

ALARM 39, Heatsink Sensor:

No feedback from the heatsink sensor.

WARNING 40, Overload of Digital Output Terminal 27

Check the load connected to terminal 27 or remove short-circuit connection. Check parameters 5-00 and 5-01.

WARNING 41, Overload of Digital Output Terminal 29:

Check the load connected to terminal 29 or remove short-circuit connection. Check parameters 5-00 and 5-02.

WARNING 42, Overload of Digital Output On X30/6 :

Check the load connected to X30/6 or remove short-circuit connection. Check parameter 5-32.

WARNING 42, Overload of Digital Output On X30/7 :

Check the load connected to X30/7 or remove short-circuit connection. Check parameter 5-33.

ALARM 46, Pwr. card supply:

The supply on the power card is out of range.

WARNING 47, 24 V supply low:

The external 24 V DC backup power supply may be overloaded, otherwise contact your Danfoss supplier.

ALARM 48, 1.8 V supply low:

Contact your Danfoss supplier.

WARNING 49, Speed limit:

The speed has been limited by range in par. 4-11 *Motor Speed Low Limit [RPM]* and par. 4-13 *Motor Speed High Limit [RPM]*.

ALARM 50, AMA calibration failed:

Contact your Danfoss supplier.

ALARM 51, AMA check Unom and Inom:

The setting of motor voltage, motor current, and motor power is presumably wrong. Check the settings.

ALARM 52, AMA low Inom:

The motor current is too low. Check the settings.

ALARM 53, AMA motor too big:

The motor is too big for the AMA to be carried out.

ALARM 54, AMA motor too small:

The motor is too small for the AMA to be carried out.

ALARM 55, AMA par. out of range:

The par. values found from the motor are outside acceptable range.



9 Troubleshooting

ALARM 56, AMA interrupted by user:

The AMA has been interrupted by the user.

ALARM 57, AMA timeout:

Try to start the AMA again a number of times, until the AMA is carried out. Please note that repeated runs may heat the motor to a level where the resistance R_s and R_r are increased. In most cases, however, this is not critical.

WARNING/ALARM 58, AMA internal fault:

Contact your Danfoss supplier.

WARNING 59, Current limit:

The current is higher than the value in par. 4-18 *Current Limit*.

WARNING 60, External Interlock:

External Interlock has been activated. To resume normal operation, apply 24 VDC to the terminal programmed for External Interlock and reset the frequency converter (via Bus, Digital I/O or by pressing [Reset]).

WARNING 62, Output Frequency at Maximum Limit:

The output frequency is limited by the value set in par. 4-19 *Max Output Frequency*.

WARNING/ALARM/TRIP 65, Control Card Over Temperature:

Control card over temperature: The cut-out temperature of the control card is 80° C.

WARNING 66, Low Temp.:

The heat sink temperature is measured to be low. This could indicate that the temperature sensor is defective and thus the fan speed is increased to the maximum in case the power part or control card is very hot.

ALARM 67, Option Configuration has Changed:

One or more options has either been added or removed since the last power-down.

ALARM 68, Safe Stop:

Safe Stop has been activated. To resume normal operation, apply 24 VDC to terminal 37 then send a Reset signal (via Bus, Digital I/O or by pressing [Reset]).

ALARM 69, Pwr. Card Temp:

Power card over temperature.

WARNING 76, Power Unit Setup:

The required number of power units does not match the detected number of active power units.

ALARM 70, Illegal Frequency Converter Configuration:

Actual combination of control board and power board is illegal.

ALARM 90, Feedback Mon.:**ALARM 92, NoFlow:**

A no load situation has been detected for the system. See parameter group 22-2*.

ALARM 93, Dry Pump:

A no flow situation and high speed indicates that the pump has run dry. See parameter group 22-2*.

ALARM 94, End of Curve:

Feed back stays lower than the set point, which may be indicates a leakage in the pipe system. See parameter group 22-5*.

ALARM 95, Broken Belt:

Torque is below the torque level set for no load indicating a broken belt. See parameter group 22-6*.

ALARM 96, Start Delayed:

Start of the motor has been delayed due to short cycle protection is active. See parameter group 22-7*.

ALARM 220, Overload Trip:

Motor overload has tripped. Indicates excess motor load. Check motor and driven load. To reset press the "Off Reset" key. Then, to restart the system, press the "Auto On" or "Hand On" key.

WARNING/ALARM 243, Brake IGBT:

The brake transistor is short-circuited or the brake function is disconnected. Turn off the frequency converter as a fire precaution. Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

WARNING/ALARM 244, Heatsink Temp:

Drive heatsink over temperature: Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 245, Heatsink Sensor:

No feedback from the heatsink sensor Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 246, Pwr. Card Supply:

The supply on the power card is out of range Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 247, Pwr. Card Temp:

Power card over temperature Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 248, Illegal PS Config:

Power size configuration fault on the power card Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 250, New Spare Part:

The power or Switch Mode Power Supply has been exchanged. The frequency converter type code must be restored in the EEPROM. Select the correct type code in Par 14-23 according to the label on unit. Remember to select 'Save to EEPROM' to complete.

ALARM 251, New Type Code:

The frequency converter has got a new type code.

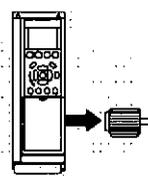
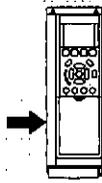
10 Specifications

10.1 General Specifications

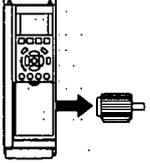
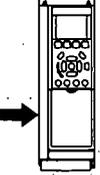
10



10.1.1 Mains Supply 1 x 200 - 240 VAC

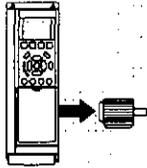
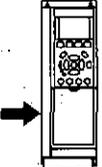
Mains Supply 1 x 200 - 240 VAC - Normal overload 110% for 1 minute										
Frequency converter	P1K1	P1K5	P2K2	P3K0	P3K7	P5K5	P7K5	P15K	P22K	
Typical Shaft-Output [kW]	1.1	1.5	2.2	3.0	3.7	5.5	7.5	15	22	
Typical Shaft-Output [HP] at 240 V	1.5	2.0	2.9	4.0	4.9	7.5	10	20	30	
IP 20 / Chassis	A3									
IP 21 / NEMA 1		B1	B1	B1	B1	B1	B2	C1	C2	
IP 55 / NEMA 12	A5	B1	B1	B1	B1	B1	B2	C1	C2	
IP 66	A5	B1	B1	B1	B1	B1	B2	C1	C2	
Output current										
	Continuous (3 x 200-240 V) [A]	6.6	7.5	10.6	12.5	16.7	24.2	30.8	59.4	88
	Intermittent (3 x 200-240 V) [A]	7.3	8.3	11.7	13.8	18.4	26.6	33.4	65.3	96.8
	Continuous kVA (208 V AC) [kVA]						5.00	6.40	12.27	18.30
	Max. cable size: (mains, motor, brake) [(mm ² / AWG) ²⁾			0.2-4 / 4-10			10/7	35/2	50/1/0	95/4/0
Max. input current										
	Continuous (1 x 200-240 V) [A]	12.5	15	20.5	24	32	46	59	111	172
	Intermittent (1 x 200-240 V) [A]	13.8	16.5	22.6	26.4	35.2	50.6	64.9	122.1	189.2
	Max. pre-fuses ³⁾ [A]	20	30	40	40	60	80	100	150	200
	Environment									
	Estimated power loss at rated max. load [W] ⁴⁾	44	30	44	60	74	110	150	300	440
	Weight enclosure IP 20 [kg]	4.9								
	Weight enclosure IP 21 [kg]		23	23	23	23	23	27	45	65
Weight enclosure IP 55 [kg]		23	23	23	23	23	27	45	65	
Weight enclosure IP 66 [kg]		23	23	23	23	23	27	45	65	
Efficiency ³⁾	0.968	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	

10.1.2 Mains Supply 3 x 200 - 240 VAC

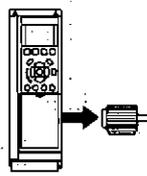
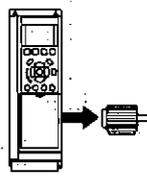
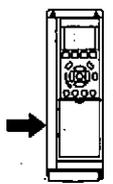
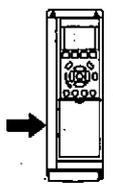
Normal overload 110% for 1 minute										
IP 20 / NEMA Chassis	A2	A2	A2	A2	A2	A2	A2	A3	A3	
IP 21 / NEMA 1	A2	A2	A2	A2	A2	A2	A2	A3	A3	
IP 55 / NEMA 12	A5	A5	A5	A5	A5	A5	A5	A5	A5	
IP 66	A5	A5	A5	A5	A5	A5	A5	A5	A5	
Mains supply 200 - 240 VAC										
Frequency converter	PK25	PK37	PK55	PK75	P1K1	P1K5	P2K2	P3K0	P3K7	
Typical Shaft Output [kW]	0.25	0.37	0.55	0.75	1.1	1.5	2.2	3	3.7	
Typical Shaft Output [HP] at 208 V	0.25	0.37	0.55	0.75	1.5	2.0	2.9	4.0	4.9	
Output current										
	Continuous (3 x 200-240 V) [A]	1.8	2.4	3.5	4.6	6.6	7.5	10.6	12.5	16.7
	Intermittent (3 x 200-240 V) [A]	1.98	2.64	3.85	5.06	7.26	8.3	11.7	13.8	18.4
	Continuous kVA (208 V AC) [kVA]	0.65	0.86	1.26	1.66	2.38	2.70	3.82	4.50	6.00
	Max. cable size: (mains, motor, brake) [mm ² /AWG] ²⁾	0.2 - 4 mm ² / 4 - 10 AWG								
Max. input current										
	Continuous (3 x 200-240 V) [A]	1.6	2.2	3.2	4.1	5.9	6.8	9.5	11.3	15.0
	Intermittent (3 x 200-240 V) [A]	1.7	2.42	3.52	4.51	6.5	7.5	10.5	12.4	16.5
	Max. pre-fuses ¹⁾ [A]	10	10	10	10	20	20	20	32	32
	Environment									
	Estimated power loss at rated max. load [W] ⁴⁾	21	29	42	54	63	82	116	155	185
	Weight enclosure IP20 [kg]	4.9	4.9	4.9	4.9	4.9	4.9	4.9	6.6	6.6
	Weight enclosure IP21 [kg]	5.5	5.5	5.5	5.5	5.5	5.5	5.5	7.5	7.5
Weight enclosure IP55 [kg]	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	
Weight enclosure IP 66 [kg]	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	
Efficiency ³⁾	0.94	0.94	0.95	0.95	0.96	0.96	0.96	0.96	0.96	

MG 20.M7.02 - VLTR® is a registered Danfoss trademark



Mains supply 3 x 200 - 240 VAC - Normal overload 110% for 1 minute										
IP 20 / NEMA Chassis (B3+4 and C3+4 may be converted to IP21 using a conversion kit (Please contact Danfoss))	B3	B3	B3	B4	B4	C3	C3	C4	C4	
IP 21 / NEMA 1	B1	B1	B1	B2	C1	C1	C1	C2	C2	
IP 55 / NEMA 12	B1	B1	B1	B2	C1	C1	C1	C2	C2	
IP 66	B1	B1	B1	B2	C1	C1	C1	C2	C2	
Frequency converter	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	
Typical Shaft Output [kW]	5.5	7.5	11	15	18.5	22	30	37	45	
Typical Shaft Output [HP] at 208 V	7.5	10	15	20	25	30	40	50	60	
Output current										
	Continuous (3 x 200-240 V) [A]	24.2	30.8	46.2	59.4	74.8	88.0	115	143	170
	Intermittent (3 x 200-240 V) [A]	26.6	33.9	50.8	65.3	82.3	96.8	127	157	187
	Continuous kVA (208 V AC) [kVA]	8.7	11.1	16.6	21.4	26.9	31.7	41.4	51.5	61.2
	Max. cable size: (mains, motor, brake) [mm ² /AWG] ²⁾		10/7		35/2		50/1/0		95/4/0	120/250 MCM
Max. input current										
	Continuous (3 x 200-240 V) [A]	22.0	28.0	42.0	54.0	68.0	80.0	104.0	130.0	154.0
	Intermittent (3 x 200-240 V) [A]	24.2	30.8	46.2	59.4	74.8	88.0	114.0	143.0	169.0
	Max. pre-fuses ¹⁾ [A]	63	63	63	80	125	125	160	200	250
	Environment:									
	Estimated power loss at rated max. load [W] ⁴⁾	269	310	447	602	737	845	1140	1353	1636
	Weight enclosure IP20 [kg]	12	12	12	23.5	23.5	35	35	50	50
	Weight enclosure IP21 [kg]	23	23	23	27	45	45	65	65	65
	Weight enclosure IP55 [kg]	23	23	23	27	45	45	65	65	65
Weight enclosure IP 66 [kg]	23	23	23	27	45	45	65	65	65	
Efficiency ³⁾	0.96	0.96	0.96	0.96	0.96	0.97	0.97	0.97	0.97	

10.1.3 Mains Supply 1 x 380 - 480 VAC

Mains Supply 1x 380 VAC - Normal overload 110% for 1 minute					
	P7K5	P11K	P18K	P37K	
Frequency converter					
Typical Shaft Output [kW]	7.5	11	18.5	37	
Typical Shaft Output [HP] at 460 V	10	15	25	50	
IP 21 / NEMA 1	B1	B2	C1	C2	
IP 55 / NEMA 12	B1	B2	C1	C2	
IP 66	B1	B2	C1	C2	
Output current					
	Continuous (3 x 380-440 V) [A]	16	24	37.5	73
	Intermittent (3 x 380-440 V) [A]	17.6	26.4	41.2	80.3
	Continuous (3 x 441-480 V) [A]	14.5	21	34	65
	Intermittent (3 x 441-480 V) [A]	15.4	23.1	37.4	71.5
	Continuous kVA (400 V AC) [kVA]	11.0	16.6	26	50.6
	Continuous kVA (460 V AC) [kVA]	11.6	16.7	27.1	51.8
	Max. cable size: (mains, motor, brake) [[mm ² / AWG] ²⁾	10/7	35/2	50/1/0	120/4/0
Max. input current					
	Continuous (1 x 380-440 V) [A]	33	48	78	151
	Intermittent (1 x 380-440 V) [A]	36	53	85.8	166
	Continuous (1 x 441-480 V) [A]	30	41	72	135
	Intermittent (1 x 441-480 V) [A]	33	46	79.2	148
	Max. pre-fuses ¹⁾ [A]	63	80	160	250
Environment					
	Estimated power loss at rated max. load [W] ⁴⁾	300	440	740	1480
	Weight enclosure IP 21 [kg]	23	27	45	65
	Weight enclosure IP 55 [kg]	23	27	45	65
	Weight enclosure IP 66 [kg]	23	27	45	65
	Efficiency ³⁾	0.96	0.96	0.96	0.96

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10.1.4 Mains Supply 3 x 380 - 480 VAC

Mains Supply 3 x 380 - 480 VAC - Normal overload 110% for 1 minute

Frequency converter	PK37	PK55	PK75	P1K1	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5
Typical Shaft Output [kW]	0.37	0.55	0.75	1.1	1.5	2.2	3	4	5.5	7.5
Typical Shaft Output [HP] at 460 V	0.5	0.75	1.0	1.5	2.0	2.9	4.0	5.3	7.5	10
IP 20 / NEMA Chassis	A2	A3	A3							
IP 21 / NEMA 1										
IP 55 / NEMA 12	A5									
IP 66	A5	AA	A5							

Output current

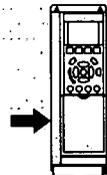
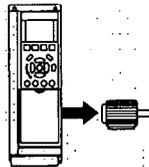
Continuous (3 x 380-440 V) [A]	1.3	1.8	2.4	3	4.1	5.6	7.2	10	13	16
Intermittent (3 x 380-440 V) [A]	1.43	1.98	2.64	3.3	4.5	6.2	7.9	11	14.3	17.6
Continuous (3 x 441-480 V) [A]	1.2	1.6	2.1	2.7	3.4	4.8	6.3	8.2	11	14.5
Intermittent (3 x 441-480 V) [A]	1.32	1.76	2.31	3.0	3.7	5.3	6.9	9.0	12.1	15.4
Continuous kVA (400 V AC) [kVA]	0.9	1.3	1.7	2.1	2.8	3.9	5.0	6.9	9.0	11.0
Continuous kVA (460 V AC) [kVA]	0.9	1.3	1.7	2.4	2.7	3.8	5.0	6.5	8.8	11.6
Max. cable size: (mains, motor, brake) [mm ² / AWG] ²⁾	4/10									

Max. input current

Continuous (3 x 380-440 V) [A]	1.2	1.6	2.2	2.7	3.7	5.0	6.5	9.0	11.7	14.4
Intermittent (3 x 380-440 V) [A]	1.32	1.76	2.42	3.0	4.1	5.5	7.2	9.9	12.9	15.8
Continuous (3 x 441-480 V) [A]	1.0	1.4	1.9	2.7	3.1	4.3	5.7	7.4	9.9	13.0
Intermittent (3 x 441-480 V) [A]	1.1	1.54	2.09	3.0	3.4	4.7	6.3	8.1	10.9	14.3
Max. pre-fuses ¹⁾ [A]	10	10	10	10	10	20	20	20	30	30
Environment										
Estimated power loss at rated max. load [W] ⁴⁾	35	42	46	58	62	88	116	124	187	255
Weight enclosure IP20 [kg]	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	6.6	6.6
Weight enclosure IP 21 [kg]										
Weight enclosure IP 55 [kg]	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	14.2	14.2
Weight enclosure IP 66 [kg]	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	14.2	14.2
Efficiency ³⁾	0.93	0.95	0.96	0.96	0.97	0.97	0.97	0.97	0.97	0.97

150

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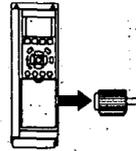
Mains Supply 3 x 380 - 480 VAC - Normal overload 110% for 1 minute											
	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K	
Frequency converter											
Typical Shaft Output [kW]	11	15	18.5	22	30	37	45	55	75	90	
Typical Shaft Output [HP] at 460 V	15	20	25	30	40	50	60	75	100	125	
IP 20 / NEMA Chassis (B3+4 and C3+4 may be converted to IP21 using a conversion kit (Please contact Danfoss))	B3	B3	B3	B4	B4	B4	C3	C3	C4	C4	
IP 21 / NEMA 1	B1	B1	B1	B2	B2	C1	C1	C1	C2	C2	
IP 55 / NEMA 12	B1	B1	B1	B2	B2	C1	C1	C1	C2	C2	
IP 66	B1	B1	B1	B2	B2	C1	C1	C1	C2	C2	
Output current											
	Continuous (3 x 380-440 V) [A]	24	32	37.5	44	61	73	90	106	147	177
	Intermittent (3 x 380-440 V) [A]	26.4	35.2	41.3	48.4	67.1	80.3	99	117	162	195
	Continuous (3 x 441-480 V) [A]	21	27	34	40	52	65	80	105	130	160
	Intermittent (3 x 441-480 V) [A]	23.1	29.7	37.4	44	61.6	71.5	88	116	143	176
	Continuous kVA (400 V AC) [kVA]	16.6	22.2	26	30.5	42.3	50.6	62.4	73.4	102	123
	Continuous kVA (460 V AC) [kVA]	16.7	21.5	27.1	31.9	41.4	51.8	63.7	83.7	104	128
	Max. cable size: (mains, motor, brake) [[mm ² / AWG] ²⁾		10/7		35/2		50/1/0		120/4/0	120/4/0	
	Max. input current										
	Continuous (3 x 380-440 V) [A]	22	29	34	40	55	66	82	96	133	161
	Intermittent (3 x 380-440 V) [A]	24.2	31.9	37.4	44	60.5	72.6	90.2	106	146	177
	Continuous (3 x 441-480 V) [A]	19	25	31	36	47	59	73	95	118	145
	Intermittent (3 x 441-480 V) [A]	20.9	27.5	34.1	39.6	51.7	64.9	80.3	105	130	160
	Max. pre-fuses ¹⁾ [A]	63	63	63	63	80	100	125	160	250	250
	Environment										
	Estimated power loss at rated max. load [W] ⁴⁾	278	392	465	525	698	739	843	1083	1384	1474
	Weight enclosure IP20 [kg]	12	12	12	23.5	23.5	23.5	35	35	50	50
	Weight enclosure IP 21 [kg]	23	23	23	27	27	45	45	45	65	65
	Weight enclosure IP 55 [kg]	23	23	23	27	27	45	45	45	65	65
Weight enclosure IP 66 [kg]	23	23	23	27	27	45	45	45	65	65	
Efficiency ³⁾	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.99	

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Normal overload 110% for 1 minute

Frequency converter	P110	P132	P160	P200	P250	P315	P355	P400	P450	P500	P560	P630	P710	P800	P1M0
Typical Shaft Output [kW] at 400V	110	132	160	200	250	315	355	400	450	500	560	630	710	800	1000
Typical Shaft Output [HP] at 460V	150	200	250	300	350	450	500	550	600	700	750	900	1000	1200	1350
IP 00	D3	D3	D4	D4	D4	E2	E2	E2	E2	F1/F3	F1/F3	F1/F3	F1/F3	F2/F4	F2/F4
IP 21 / Nema 1	D1	D1	D2	D2	D2	E1	E1	E1	E1	F1/F3	F1/F3	F1/F3	F1/F3	F2/F4	F2/F4
IP 54 / Nema 12	D1	D1	D2	D2	D2	E1	E1	E1	E1	F1/F3	F1/F3	F1/F3	F1/F3	F2/F4	F2/F4

Output current

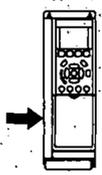


Continuous (3 x 380-440 V) [A]	212	260	315	395	480	600	658	745	800	880	990	1120	1260	1460	1720
Intermittent (3 x 380-440 V) [A]	233	286	347	435	528	660	724	820	880	968	1089	1232	1386	1606	1892
Continuous (3 x 441-480V) [A]	190	240	302	361	443	540	590	678	730	780	890	1050	1160	1380	1530
Intermittent (3 x 441-480V) [A]	209	264	332	397	487	594	649	746	803	858	979	1155	1276	1518	1683
Continuous kVA (400 VAC) [kVA]	147	180	218	274	333	416	456	516	554	610	686	776	873	1012	1192
Continuous kVA (460 VAC) [kVA]	151	191	241	288	353	430	470	540	582	621	709	837	924	1100	1219

Max. cable size:

(motor,) [mm ² / AWG ²]	2x70 2x2/0	2x185 2x300 mcm	4x240 4x500 mcm	8x150 8x300 mcm	12x150 12x300 mcm
(mains,) [mm ² / AWG ²]	2x70 2x2/0	2x185 2x300 mcm	4x240 4x500 mcm	8x240 8x500 mcm	
(loadsharing) [mm ² / AWG ²]	2x70 2x2/0	2x185 2x300 mcm	4x240 4x500 mcm	4x120 4x250 mcm	
(brake) [mm ² / AWG ²]	2x70 2x2/0	2x185 2x300 mcm	2x185 2x350 mcm	4x185 4x350 mcm	6x185 6x350 mcm

Max. input current



Continuous (3 x 380-440 V) [A]	204	251	304	381	463	590	647	733	787	857	964	1090	1227	1422	1675
Continuous (3 x 441-480V) [A]	183	231	291	348	427	531	580	667	718	759	867	1022	1129	1344	1490
Max. pre-fuses ¹⁾ [A]	300	350	400	500	630	700	900	900	900	1600	1600	2000	2000	2500	2500
Environment:															
Estimated power loss ⁴⁾ at 400 VAC at rated max. load [W]	3234	3782	4213	5119	5893	6790	7701	8879	9670	10647	12338	13201	15436	18084	20358
Estimated power loss ⁴⁾ at 460 VAC at rated max. load [W]	2947	3665	4063	4652	5634	6082	6953	8089	8803	9414	11006	12353	14041	17137	17752
Weight enclosure IP00 [kg]	82	91	112	123	138	221	234	236	277						
Weight enclosure IP 21 [kg]	96	104	125	136	151	263	270	272	313	1004	1004	1004	1004	1246	1246
Weight enclosure IP 54 [kg]	96	104	125	136	151	263	270	272	313	1299	1299	1299	1299	1541	1541
Efficiency ³⁾	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

¹⁾ For type of fuse see section *Fuses*

²⁾ American-Wire Gauge

³⁾ Measured using 5 m screened motor cables at rated load and rated frequency

⁴⁾ The typical power loss is at normal load-conditions and expected to be within +/- 15% (tolerance relates to variety in voltage and cable conditions).

Values are based on a typical motor efficiency (eff2/eff3 border line). Lower efficiency motors will also add to the power loss in the frequency converter and vice versa.

If the switching frequency is raised from nominal the power losses may rise significantly.

LCP and typical control card power consumptions are included. Further options and customer load may add up to 30 Watts to the losses. (Though typically only 4 Watts extra for a fully loaded control card or options for slot A or slot B, each).

Although measurements are made with state of the art equipment, some measurement inaccuracy must be allowed for (+/- 5%).

10.1.5 Mains Supply 3 x 525 - 600 VAC

Normal overload 110% for 1 minute																		
Size:	PK75	P1K1	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical Shaft Output [kW]	0.75	1.1	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
IP 20 / NEMA Chassis	A2	A2	A2	A2	A2	A2	A3	A3	B3	B3	B3	B4	B4	B4	C3	C3	C4	C4
IP 21 / NEMA 1	A2	A2	A2	A2	A2	A2	A3	A3	B1	B1	B1	B2	B2	B2	C1	C1	C2	C2
IP 55 / NEMA 12	A5	A5	A5	A5	A5	A5	A5	A5	B1	B1	B1	B2	B2	B2	C1	C1	C2	C2
IP 66	A5	A5	A5	A5	A5	A5	A5	A5	B1	B1	B1	B2	B2	B2	C1	C1	C2	C2
Output current																		
Continuous (3 x 525-550 V) [A]	1.8	2.6	2.9	4.1	5.2	6.4	9.5	11.5	19	23	28	36	43	54	65	87	105	137
Intermittent (3 x 525-550 V) [A]		2.9	3.2	4.5	5.7	7.0	10.5	12.7	21	25	31	40	47	59	72	96	116	151
Continuous (3 x 525-600 V) [A]	1.7	2.4	2.7	3.9	4.9	6.1	9.0	11.0	18	22	27	34	41	52	62	83	100	131
Intermittent (3 x 525-600 V) [A]		2.6	3.0	4.3	5.4	6.7	9.9	12.1	20	24	30	37	45	57	68	91	110	144
Continuous kVA (525 V AC) [kVA]	1.7	2.5	2.8	3.9	5.0	6.1	9.0	11.0	18.1	21.9	26.7	34.3	41	51.4	61.9	82.9	100	130.5
Continuous kVA (575 V AC) [kVA]	1.7	2.4	2.7	3.9	4.9	6.1	9.0	11.0	17.9	21.9	26.9	33.9	40.8	51.8	61.7	82.7	99.6	130.5
Max. cable size (mains, motor, brake) [AWG] ²⁾ [mm ²]	24 - 10 AWG 0.2 - 4								6 16			2 35			1 50		3/0 95 ⁵⁾	
Max. input current																		
Continuous (3 x 525-600 V) [A]	1.7	2.4	2.7	4.1	5.2	5.8	8.6	10.4	17.2	20.9	25.4	32.7	39	49	59	78.9	95.3	124.3
Intermittent (3 x 525-600 V) [A]		2.7	3.0	4.5	5.7	6.4	9.5	11.5	19	23	28	36	43	54	65	87	105	137
Max. pre-fuses ¹⁾ [A]	10	10	10	20	20	20	32	32	40	40	50	60	80	100	150	160	225	250
Environment:																		
Estimated power loss at rated max. load [W] ⁴⁾	35	50	65	92	122	145	195	261	225	285	329	460	560	740	860	890	1020	1130
Weight [kg]:																		
Enclosure IP20	6.5	6.5	6.5	6.5	6.5	6.5	6.6	6.6	12	12	12	23.5	23.5	23.5	35	35	50	50
Efficiency ⁴⁾	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Table 10.1: ⁵⁾ Motor and mains cable: 300MCM/150mm²

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10.1.6 Mains Supply 3 x 525 - 690 VAC

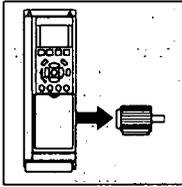
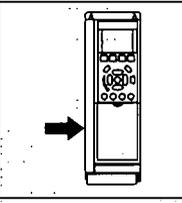
Normal overload 110% for 1 minute											
Size:	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K	
Typical Shaft Output [kW]	11	15	18.5	22	30	37	45	55	75	90	
Typical Shaft Output [HP] at 575 V	10	16.4	20.1	24	33	40	50	60	75	100	
IP 21 / NEMA 1	B2	B2	B2	B2	B2	C2	C2	C2	C2	C2	
IP 55 / NEMA 12	B2	B2	B2	B2	B2	C2	C2	C2	C2	C2	
Output current											
	Continuous (3 x 525-550 V) [A]	14	19	23	28	36	43	54	65	87	105
	Intermittent (3 x 525-550 V) [A]	15.4	20.9	25.3	30.8	39.6	47.3	59.4	71.5	95.7	115.5
	Continuous (3 x 551-690 V) [A]	13	18	22	27	34	41	52	62	83	100
	Intermittent (3 x 551-690 V) [A]	14.3	19.8	24.2	29.7	37.4	45.1	57.2	68.2	91.3	110
	Continuous kVA (550 V AC) [kVA]	13.3	18.1	21.9	26.7	34.3	41	51.4	61.9	82.9	100
	Continuous kVA (575 V AC) [kVA]	12.9	17.9	21.9	26.9	33.8	40.8	51.8	61.7	82.7	99.6
	Continuous kVA (690 V AC) [kVA]	15.5	21.5	26.3	32.3	40.6	49	62.1	74.1	99.2	119.5
	Max. cable size (mains, motor, brake) [mm ²]/[AWG] ²⁾			35 1/0					95 4/0		
	Max. input current										
		Continuous (3 x 525-690 V) [A]	15	19.5	24	29	36	49	59	71	87
Intermittent (3 x 525-690 V) [A]		16.5	21.5	26.4	31.9	39.6	53.9	64.9	78.1	95.7	108.9
Max. pre-fuses ³⁾ [A]		63	63	63	63	80	100	125	160	160	160
Environment:											
Estimated power loss at rated max. load [W] ⁴⁾		201	285	335	375	430	592	720	880	1200	1440
Weight:											
IP21 [kg]		27	27	27	27	27	65	65	65	65	65
IP55 [kg]		27	27	27	27	27	65	65	65	65	65
Efficiency ⁴⁾	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	

Table 10.2: ⁵⁾ Motor and mains cable: 300MCM/150mm²



10.1.7 Mains Supply 3 x 525 - 690 VAC

Normal overload 110% for 1 minute																				
Frequency converter	P45K	P55K	P75K	P90K	P110	P132	P160	P200	P250	P315	P400	P450	P500	P560	P630	P710	P800	P900	P1M0	P1M2
Typical Shaft Output [kW]	45	55	75	90	110	132	160	200	250	315	400	450	500	560	630	710	800	900	1000	1200
Typical Shaft Output [HP] at 575 V	50	60	75	100	125	150	200	250	300	350	400	450	500	600	650	750	950	1050	1150	1350
IP 00	D3	D3	D3	D3	D3	D3	D3	D4	D4	D4	D4	E2	E2	E2	E2					
IP 21 / Nema 1	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	E1	E1	E1	E1	F1/F3 ⁶⁾	F1/F3 ⁶⁾	F1/F3 ⁶⁾	F2/F4 ⁶⁾	F2/F4 ⁶⁾
IP 54 / Nema 12	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	E1	E1	E1	E1	F1/F3 ⁶⁾				
Output current																				
Continuous (3 x 550 V) [A]	56	76	90	113	137	162	201	253	303	360	418	470	523	596	630	763	889	988	1108	1317
Intermittent (3 x 550 V) [A]	62	84	99	124	151	178	221	278	333	396	460	517	575	656	693	839	978	1087	1219	1449
Continuous (3 x 690V) [A]	54	73	86	108	131	155	192	242	290	344	400	450	500	570	630	730	850	945	1060	1260
Intermittent (3 x 690 V) [A]	59	80	95	119	144	171	211	266	319	378	440	495	550	627	693	803	935	1040	1166	1386
Continuous kVA (550 VAC) [kVA]	53	72	86	108	131	154	191	241	289	343	398	448	498	568	600	727	847	941	1056	1255
Continuous kVA (575 VAC) [kVA]	54	73	86	108	130	154	191	241	289	343	398	448	498	568	627	727	847	941	1056	1255
Continuous kVA (690 VACr) [kVA]	65	87	103	129	157	185	229	289	347	411	478	538	598	681	753	872	1016	1129	1267	1506
Max. cable size:																				
(Mains) [mm ² / AWG] ²⁾	2x70							2x185					4x240				8x240		8x240	
	2x2/0							2x300 mcm					4x500 mcm				8x500 mcm		8x500 mcm	
(Motor) [mm ² / AWG] ²⁾	2x70							2x185					4x240				8x150		12x150	
	2x2/0							2x300 mcm					4x500 mcm				8x300 mcm		12x300 mcm	
(Brake) [mm ² / AWG] ²⁾	2x70							2x185					2x185				4x185		6x185	
	2x2/0							2x300 mcm					2x350 mcm				4x350 mcm		6x350 mcm	
Max. input current																				
Continuous (3 x 550 V) [A]	60	77	89	110	130	158	198	245	299	355	408	453	504	574	607	743	866	962	1079	1282
Continuous (3 x 575 V) [A]	58	74	85	106	124	151	189	224	286	339	390	434	482	549	607	711	828	920	1032	1227
Continuous (3 x 690 V) [A]	58	77	87	109	128	155	197	240	296	352	400	434	482	549	607	711	828	920	1032	1227
Max. mains pre-fuses ¹⁾ [A]	125	160	200	200	250	315	350	350	400	500	550	700	700	900	900	2000	2000	2000	2000	2000
Environment:																				
Estimated power loss at 690 VAC at rated max. load [W] ⁴⁾	1458	1717	1913	2262	2662	3430	3612	4292	5156	5821	6149	6440	7249	8727	9673	11315	12903	14533	16375	19207
Estimated power loss at 575 VAC at rated max. load [W] ⁴⁾	1398	1645	1827	2157	2533	2963	3430	4051	4867	5493	5852	6132	6903	8343	9244	10771	12272	13835	15592	18281
Weight enclosure IP00 [kg]	82	82	82	82	82	82	91	112	123	138	151	221	221	236	277					
Weight enclosure IP 21 [kg] ⁶⁾	96	96	96	96	96	96	104	125	136	151	165	263	263	272	313	1004	1004	1004	1246	1246
Weight enclosure IP 54 [kg] ⁶⁾	96	96	96	96	96	96	104	125	136	151	165	263	263	272	313	1004	1004	1004	1246	1246
Efficiency ³⁾	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

1) For type of fuse see section *Fuses*
 2) American Wire Gauge
 3) Measured using 5 m screened motor cables at rated load and rated frequency
 4) The typical power loss is at normal load conditions and expected to be within +/- 15% (tolerance relates to variety in voltage and cable conditions). Values are based on a typical motor efficiency (eff2/eff3 border line). Lower efficiency motors will also add to the power loss in the frequency converter and vice versa.
 If the switching frequency is raised from nominal the power losses may rise significantly. LCP and typical control card power consumptions are included. Further options and customer load may add up to 30 [W] to the losses. (Though typically only 4 [W] extra for a fully loaded control card, or options for slot A or slot B, each).
 Although measurements are made with state of the art equipment, some measurement inaccuracy must be allowed for (+/- 5%).
 6) Adding the F-enclosure option cabinet (resulting in the F3 and F4 enclosure sizes) adds 295 kg to the estimated weight.

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10 Specifications

Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the frequency converter trips if the temperature reaches 95 °C ± 5°C. An overload temperature cannot be reset until the temperature of the heatsink is below 70 °C ± 5°C (Guideline - these temperatures may vary for different power sizes, enclosures etc.). VLT AQUA Drive has an auto derating function to avoid it's heatsink reaching 95 deg C.
- The frequency converter is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the frequency converter trips or issues a warning (depending on the load).
- Monitoring of the intermediate circuit voltage ensures that the frequency converter trips if the intermediate circuit voltage is too low or too high.
- The frequency converter is protected against earth faults on motor terminals U, V, W.

Mains supply (L1, L2, L3):

Supply voltage	200-240 V ±10%
Supply voltage	380-480 V ±10%
Supply voltage	525-600 V ±10%
Supply voltage	525-690 V ±10%

Mains voltage low / mains drop-out:

During low mains voltage or a mains drop-out, the FC continues until the intermediate circuit voltage drops below the minimum stop level, which corresponds typically to 15% below the FC's lowest rated supply voltage. Power-up and full torque cannot be expected at mains voltage lower than 10% below the FC's lowest rated supply voltage.

Supply frequency	50/60 Hz +4/-6%
------------------	-----------------

The frequency converter power supply is tested in accordance with IEC61000-4-28, 50 Hz +4/-6%.

Max. imbalance temporary between mains phases	3.0 % of rated supply voltage
---	-------------------------------

True Power Factor (λ)	≥ 0.9 nominal at rated load
-----------------------	-----------------------------

Displacement Power Factor (cosφ) near unity	(> 0.98)
---	----------

Switching on input supply L1, L2, L3 (power-ups) ≤ enclosure type A	maximum 2 times/min.
---	----------------------

Switching on input supply L1, L2, L3 (power-ups) ≥ enclosure type B, C	maximum 1 time/min.
--	---------------------

Switching on input supply L1, L2, L3 (power-ups) ≥ enclosure type D, E, F	maximum 1 time/2 min.
---	-----------------------

Environment according to EN60664-1	overvoltage category III/pollution degree 2
------------------------------------	---

The unit is suitable for use on a circuit capable of delivering not more than 100.000 RMS symmetrical Amperes, 240/480 V maximum.

Motor output (U, V, W):

Output voltage	0 - 100% of supply voltage
Output frequency	0 - 1000 Hz*
Switching on output	Unlimited
Ramp times	1 - 3600 sec.

** Dependent on power size.*

Torque characteristics:

Starting torque (Constant torque)	maximum 110% for 1 min.*
-----------------------------------	--------------------------

Starting torque	maximum 135% up to 0.5 sec.*
-----------------	------------------------------

Overload torque (Constant torque)	maximum 110% for 1 min.*
-----------------------------------	--------------------------

**Percentage relates to VLT AQUA Drive's nominal torque.*

Cable lengths and cross sections:

Max. motor cable length, screened/armoured	VLT AQUA Drive: 150 m
Max. motor cable length, unscreened/unarmoured	VLT AQUA Drive: 300 m
Max. cross section to motor, mains, load sharing and brake *	
Maximum cross section to control terminals, rigid wire	1.5 mm ² /16 AWG (2 x 0.75 mm ²)
Maximum cross section to control terminals, flexible cable	1 mm ² /18 AWG
Maximum cross section to control terminals, cable with enclosed core	0.5 mm ² /20 AWG
Minimum cross section to control terminals	0.25 mm ²

** See Mains Supply tables for more information!*

Control card, RS-485 serial communication:

Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
-----------------	----------------------------------

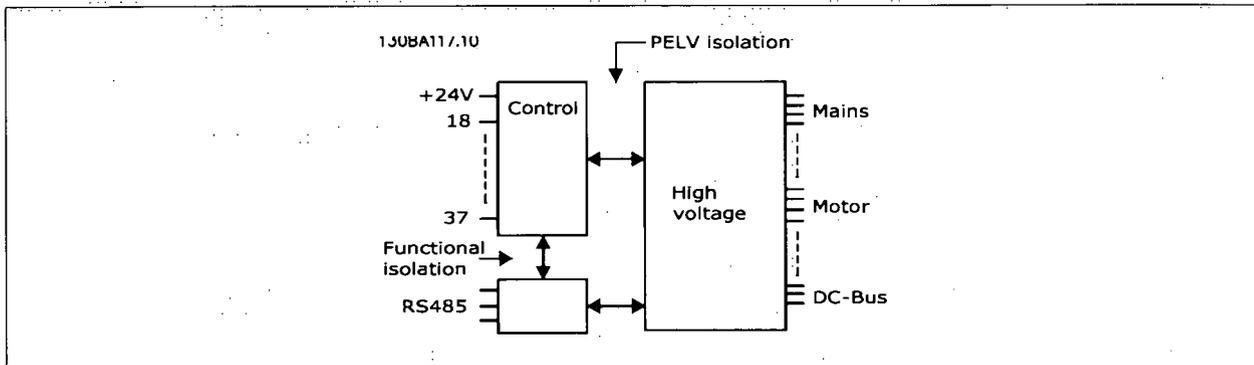
Terminal number 61	Common for terminals 68 and 69
--------------------	--------------------------------

The RS-485 serial communication circuit is functionally seated from other central circuits and galvanically isolated from the supply voltage (PELV).

Analog inputs:

Number of analog inputs	2
Terminal number	53, 54
Modes	Voltage or current
Mode select	Switch S201 and switch S202
Voltage mode	Switch S201/switch S202 = OFF (U)
Voltage level	0 to + 10 V (scaleable)
Input resistance, R_i	approx. 10 k Ω
Max. voltage	\pm 20 V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20 mA (scaleable)
Input resistance, R_i	approx. 200 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	200 Hz

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.



10

Analog output:

Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 - 20 mA
Max. resistor load to common at analog output	500 Ω
Accuracy on analog output	Max. error: 0.8 % of full scale
Resolution on analog output	8 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Digital inputs:

Programmable digital inputs	4 (6)
Terminal number	18, 19, 27 ¹⁾ , 29 ¹⁾ , 32, 33,
Logic	PNP or NPN
Voltage level	0 - 24 V DC
Voltage level, logic '0' PNP	< 5 V DC
Voltage level, logic '1' PNP	> 10 V DC
Voltage level, logic '0' NPN	> 19 V DC
Voltage level, logic '1' NPN	< 14 V DC
Maximum voltage on input	28 V DC
Input resistance, R_i	approx. 4 k

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

1) Terminals 27 and 29 can also be programmed as output.

10 Specifications

Digital output:

Programmable digital/pulse outputs	2
Terminal number	27, 29 ¹⁾
Voltage level at digital/frequency output	0 - 24 V
Max. output current (sink or source)	40 mA
Max. load at frequency output	1 k Ω
Max. capacitive load at frequency output	10 nF
Minimum output frequency at frequency output	0 Hz
Maximum output frequency at frequency output	32 kHz
Accuracy of frequency output	Max. error: 0.1 % of full scale
Resolution of frequency outputs	12 bit

1) Terminal 27 and 29 can also be programmed as input.

The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Pulse inputs:

Programmable pulse inputs	2
Terminal number pulse	29, 33
Max. frequency at terminal, 29, 33	110 kHz (Push-pull driven)
Max. frequency at terminal, 29, 33	5 kHz (open collector)
Min. frequency at terminal 29, 33	4 Hz
Voltage level	see section on Digital input
Maximum voltage on input	28 V DC
Input resistance, R _i	approx. 4 k Ω
Pulse input accuracy (0.1 - 1 kHz)	Max. error: 0.1% of full scale

Control card, 24 V DC output:

Terminal number	12, 13
Max. load	: 200 mA

The 24 V DC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs.

Relay outputs:

Programmable relay outputs	2
Relay 01 Terminal number	1-3 (break), 1-2 (make)
Max. terminal load (AC-1) ¹⁾ on 1-3 (NC), 1-2 (NO) (Resistive load)	240 V AC, 2 A
Max. terminal load (AC-15) ¹⁾ (Inductive load @ cos ϕ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 1-2 (NO), 1-3 (NC) (Resistive load)	60 V DC, 1 A
Max. terminal load (DC-13) ¹⁾ (Inductive load)	24 V DC, 0.1 A
Relay 02 Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1) ¹⁾ on 4-5 (NO) (Resistive load) ²⁾³⁾	400 V AC, 2 A
Max. terminal load (AC-15) ¹⁾ on 4-5 (NO) (Inductive load @ cos ϕ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 4-5 (NO) (Resistive load)	80 V DC, 2 A
Max. terminal load (DC-13) ¹⁾ on 4-5 (NO) (Inductive load)	24 V DC, 0.1 A
Max. terminal load (AC-1) ¹⁾ on 4-6 (NC) (Resistive load)	240 V AC, 2 A
Max. terminal load (AC-15) ¹⁾ on 4-6 (NC) (Inductive load @ cos ϕ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 4-6 (NC) (Resistive load)	50 V DC, 2 A
Max. terminal load (DC-13) ¹⁾ on 4-6 (NC) (Inductive load)	24 V DC, 0.1 A
Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO)	24 V DC 10 mA, 24 V AC 20 mA
Environment according to: EN 60664-1	overvoltage category III/pollution degree 2

1) IEC 60947 t 4 and 5

The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (PELV).

2) Overvoltage Category II

3) UL applications 300 V AC 2A

Control card, 10 V DC output:

Terminal number	50
Output voltage	10.5 V \pm 0.5 V
Max. load	25 mA

The 10 V DC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.



Control characteristics:

Resolution of output frequency at 0 - 1000 Hz:	+/- 0.003 Hz
System response time (terminals 18, 19, 27, 29, 32, 33)	≤ 2 ms
Speed control range (open loop)	1:100 of synchronous speed
Speed accuracy (open loop)	30 - 4000 rpm: Maximum error of ±8 rpm

All control characteristics are based on a 4-pole asynchronous motor.

Surroundings:

Enclosure type A	IP 20/Chassis, IP 21kit/Type 1, IP55/Type12, IP 66
Enclosure type B1/B2	IP 21/Type 1, IP55/Type12, IP 66
Enclosure type B3/B4	IP20/Chassis
Enclosure type C1/C2	IP 21/Type 1, IP55/Type 12, IP66
Enclosure type C3/C4	IP20/Chassis
Enclosure type D1/D2/E1	IP21/Type 1, IP54/Type12
Enclosure type D3/D4/E2	IP00/Chassis
Enclosure kit available ≤ enclosure type A	IP21/TYPE 1/IP 4X top
Vibration test enclosure A/B/C	1.0 g
Vibration test enclosure D/E/F	0.7 g
Max. relative humidity	5% - 95%(IEC 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 721-3-3), uncoated	class 3C2
Aggressive environment (IEC 721-3-3), coated	class 3C3
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature	Max. 50 °C

Derating for high ambient temperature, see section on special conditions

Minimum ambient temperature during full-scale operation	0 °C
Minimum ambient temperature at reduced performance	- 10 °C
Temperature during storage/transport	-25 - +65/70 °C
Maximum altitude above sea level without derating	1000 m
Maximum altitude above sea level with derating	3000 m

Derating for high altitude, see section on special conditions

EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3 EN 61800-3, EN 61000-6-1/2,
EMC standards, Immunity	EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

See section on special conditions

Control card performance:

Scan interval	5 ms
Control card, USB serial communication:	
USB standard	1.1 (Full speed)
USB plug	USB type B "device" plug



Connection to PC is carried out via a standard host/device USB cable.
 The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.
 The USB connection is not galvanically isolated from protection earth. Use only isolated laptop/PC as connection to the USB connector on VLT AQUA Drive or an isolated USB cable/converter.



10 Specifications

10.2 Special Conditions

10.2.1 Purpose of Derating

Derating must be taken into account when using the frequency converter at low air pressure (heights), at low speeds, with long motor cables, cables with a large cross section or at high ambient temperature. The required action is described in this section.

10.2.2 Derating for low air pressure

The cooling capability of air is decreased at lower air pressure.

Below 1000 m altitude no derating is necessary but above 1000 m the ambient temperature (T_{AMB}) or max. output current (I_{out}) should be derated in accordance with the shown diagram.

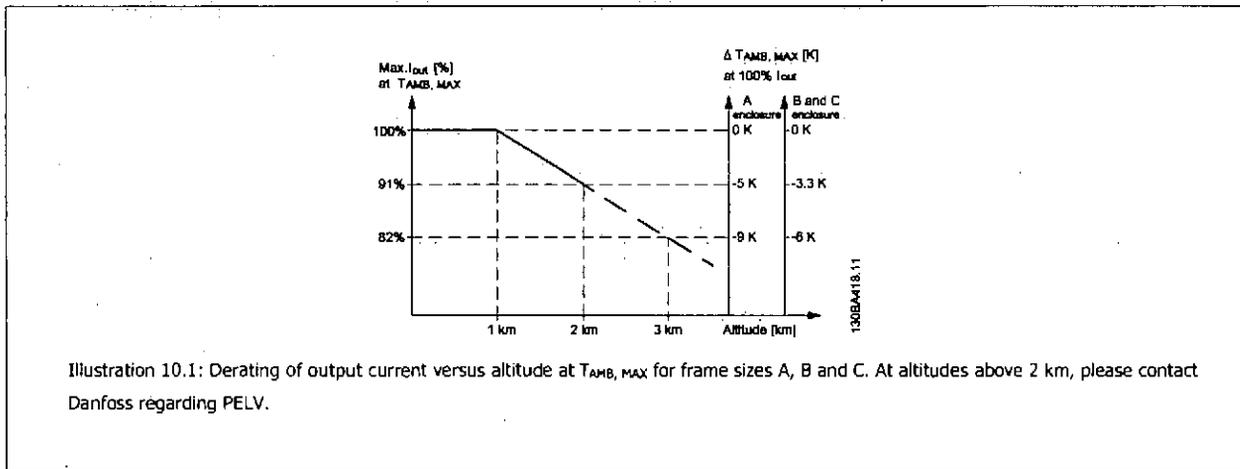
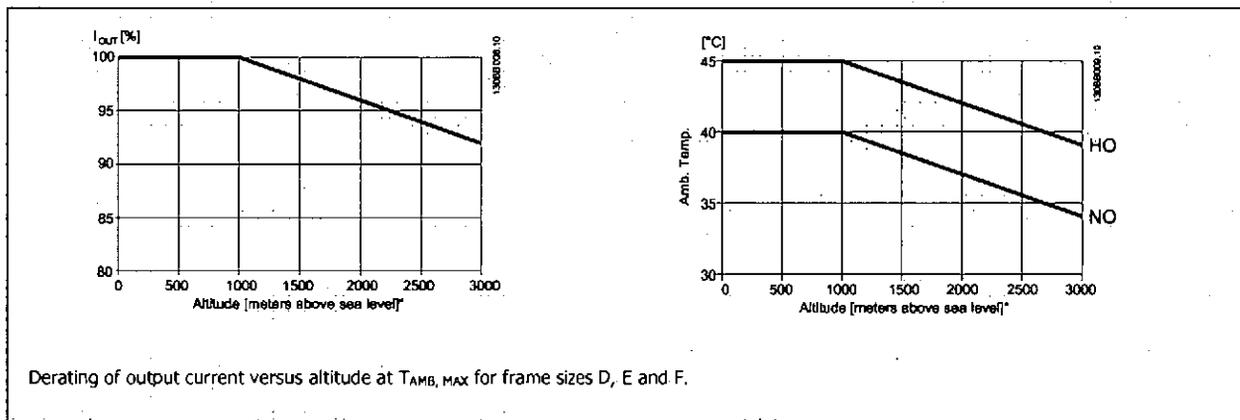


Illustration 10.1: Derating of output current versus altitude at $T_{AMB, MAX}$ for frame sizes A, B and C. At altitudes above 2 km, please contact Danfoss regarding PELV.

An alternative is to lower the ambient temperature at high altitudes and thereby ensure 100% output current at high altitudes. As an example of how to read the graph, the situation at 2 km is elaborated. At a temperature of 45° C ($T_{AMB, MAX} = 3.3$ K), 91% of the rated output current is available. At a temperature of 41.7° C, 100% of the rated output current is available.



Derating of output current versus altitude at $T_{AMB, MAX}$ for frame sizes D, E and F.

10.2.3 Derating for running at low speed

When a motor is connected to a frequency converter, it is necessary to check that the cooling of the motor is adequate. The level of heating depends on the load on the motor, as well as the operating speed and time.

Constant torque applications (CT mode)

A problem may occur at low RPM values in constant torque applications. In a constant torque application a motor may over-heat at low speeds due to less cooling air from the motor integral fan.

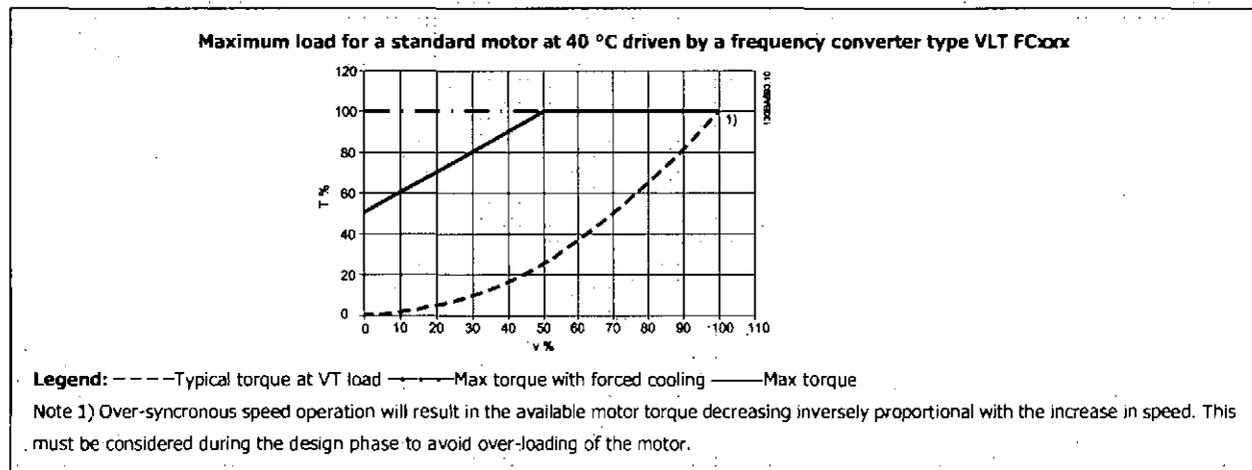
Therefore, if the motor is to be run continuously at an RPM value lower than half of the rated value, the motor must be supplied with additional air-cooling (or a motor designed for this type of operation may be used).

An alternative is to reduce the load level of the motor by choosing a larger motor. However, the design of the frequency converter puts a limit to the motor size.

Variable (Quadratic) torque applications (VT)

In VT applications such as centrifugal pumps and fans, where the torque is proportional to the square of the speed and the power is proportional to the cube of the speed, there is no need for additional cooling or de-rating of the motor.

In the graphs shown below, the typical VT curve is below the maximum torque with de-rating and maximum torque with forced cooling at all speeds.



10.2.4 Automatic adaptations to ensure performance

The frequency converter constantly checks for critical levels of internal temperature, load current, high voltage on the intermediate circuit and low motor speeds. As a response to a critical level, the frequency converter can adjust the switching frequency and / or change the switching pattern in order to ensure the performance of the frequency converter. The capability to automatically reduce the output current extends the acceptable operating conditions even further.

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APPENDIX 18



BULLOCK MFG Pty Ltd.

Model 3100

Product Description

The Bullock Model 3100 Non-return Air Damper is specifically designed to dramatically reduce the back draft of air through air conditioning or ventilation systems. Made from premium grade extruded aluminium, galvanised steel or graded stainless steel, this model damper can be installed inside rigid ductwork, conditioner plenums or in-line flanged ductwork configurations.



Model 3100 Non-Return Air Damper.

Product Features

- Single or ganged blade operation.
- Mild Steel zinc plated blade pivots or optional 316 stainless steel blade pivot available upon request.
- Standard hard wearing long life nylon pivot bushes or optional bronze for elevated temperature systems.

FRAMES

- Aluminium 0 6065T-3 extruded "C" shape frame. Size - 35mm x 150mm or 165mm wide.
- Galvanised steel - cold rolled 1.6mm thick press punched and tabbed frame. Size - 25mm or 35mm X 165mm wide, complete with TDF/TDC compatible corners.
- Stainless steel - 1.6mm premium grade 304 or 316 stainless steel frame press folded and punched for rigid stability. Size - 35mm x 165mm wide complete with TDF/TDC corners.

BLADES

- Aluminium - 0.8mm sheet, precision cut, press formed to a streamlined airflow friendly design.
- Galvanised steel - 0.8mm sheet.
- Stainless steel - 0.8mm sheet, grade 304 or 316



Blade Pivot Design



Steel/Stainless Frame



Pivot shaft and Bush

Typical Specification

Bullock Model 3100 Non-Return Air Dampers or equivalent shall be installed where shown on the drawings to suit the engineers design specifications. The dampers materials shall be determined according to the systems proximity to aggressive atmospheres, or its active purpose (Note: Dampers must not be installed in the fans turbulent zone.) Blades shall pivot on zinc plated mild steel shafts or 316 stainless steel to suit aggressive atmospheres, and shall not exceed 750mm in width. Hard wearing nylon bushes shall be used to prevent blade seizure or for systems operating at elevated temperatures above 80 deg.C bronze bushes shall be used. Frame design shall be stage and rigid to reduce flex, materials being aluminium, galvanised steel or stainless steel at a minimum 1.6mm thick.

Dampers are designed to control airflows not to structurally support the systems ductwork. Hang ductwork to Australian Standards using approved hanging methods to AS4254.

For further information contact your local representative.

BULLOCK MFG P/L – 22 Pike St. Rydalmere. NSW 2116 Ph:(02)9684 1311 Fax:(02)9684 2250
BULLOCK VIC P/L – 54 Tarnard Dr. Braeside. VIC 3195 Ph:(03)9587 5522 Fax:(03)9587 6622
BULLOCK WA P/L – 34 Industry St. Malaga. WA 6062 Ph:(08)9248 1633 Fax:(08)9248 1733
BULLOCK INDUSTRIES P/L – 26 Quindus St, Wacol. QLD 4076 Ph:(07) 3271 2088 Fax:(07)3271 1892
BULLOCK SA P/L – U1 Commercial Crt. Dry Creek. SA 5094 Ph:(08) 8349 7088 Fax:(08)8349 7066

[email:bullmfg@bigpond.net.au](mailto:bullmfg@bigpond.net.au)

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APPENDIX 19

LEGEND

- NRV: Non Return Valve
- BV : Ball Valve
- ST : Strainer
- PRV: Pressure Regulator Valve
- PI : Pressure Indicator
- FCV: Flow Control Valve
- SV : Solenoid Valve
- FS : Flow Switch
- FA : Flow Alarm
- PDI : Pressure Difference Indicator
- PW : Potable Water
- N.C. : Normally Closed
- BD : Butterfly Damper
- MH : Manhole
- AE : Analyser Element
- DR : Drainage
- MV : Variable Speed Motor
- 200-FA-PVC-100: 200mm ID, Foul Air, PVC duct, Line Number
- SP : Sampling Point
- WT : Water Trap

**WET WELL FAN
F-001**

Q = 1000 m3/hr
P = 2.0 kPa
Motor = 3 KW

**BIOFILTER
BF-001**

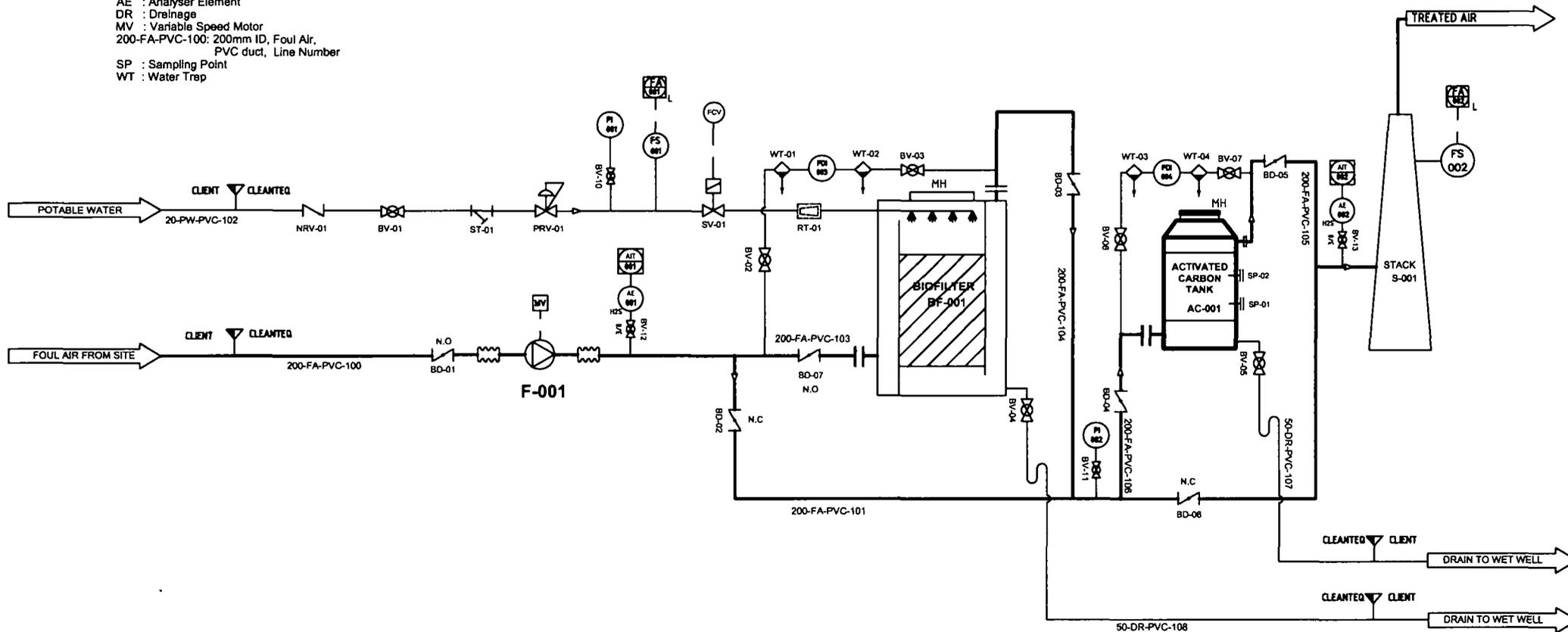
Volume = 6.5 m3
Diameter = 2.3 m
Press. Drop = 0.3 - 0.6 KPa
Bed Depth = 1.5 m
Tank Height = 2.4 m

**AC FILTER
AC-001**

Volume = 0.92 m3
Diameter = 1.5 m
Press. Drop = 0.06 - 0.1 KPa
Bed Depth = 0.52 m
Tank Height = 1.8 m

**STACK
S-001**

Height = 3.5 m
Diameter = 0.20 m



REV.	DESCRIPTION	BY	CHECKED	DATE
1	AS CONSTRUCTED	BA		11-05-09
2	ISSUED FOR CONSTRUCTION	BA		21-06-09
3	ISSUED FOR APPROVAL	BA		21-06-09
4	ISSUED FOR TENDER	HW		15-09

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CLEAN TEQ LTD
270 HAMMOND RD,
DANDENONG SOUTH,
VICTORIA, AUSTRALIA, 3175.

PH: +61 (03) 9706 8244
FAX: +61 (03) 9706 8244
EMAIL: ENG@CLEAN
WEB: WWW.CLEAN

BRISBANE CITY COUNCIL
266 George Street
Brisbane
QLD 4000

DATE: 06-05-2009
SCALE: DO NOT
CLIENT REF: 7
DRAWING NO: AB-F
REV: 2

Caswell St Pump Station Odour Control Unit
Biofilter with AC Polishing P&ID

DATE: 06-05-2009
SCALE: DO NOT
CLIENT REF: 7
DRAWING NO: AB-F
REV: 2

APPENDIX 20

APPENDIX 21



Client:
Brisbane City Council

Project:
Caswell St

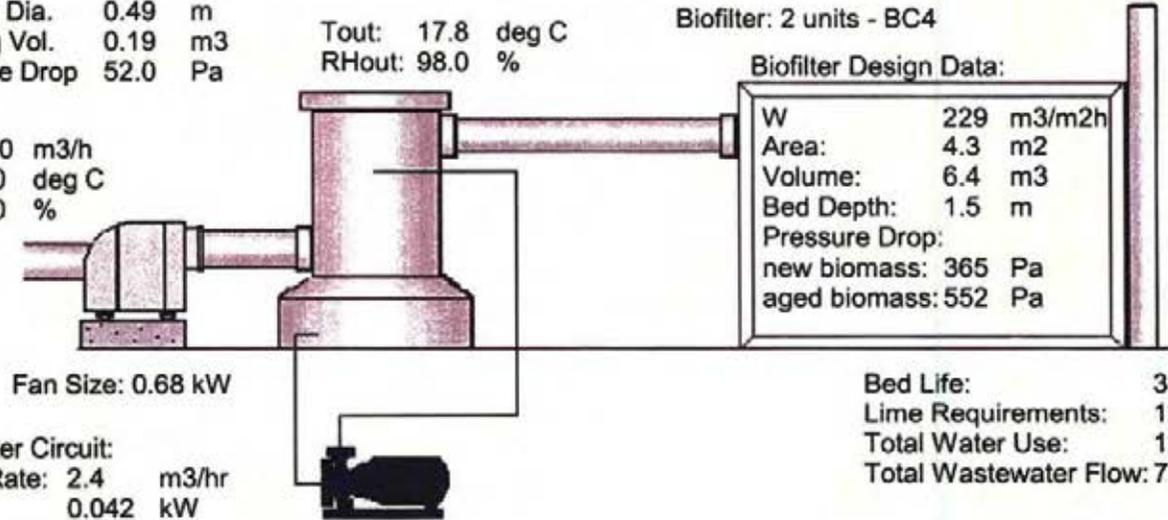
Project Number: P1676
Date / Time: 14/7/2009 10:21 am

Clean Bio - 2004
Design Program

Cin (ppm)	Contaminants	Cout (ppm)	% Removal
9.4	Hydrogen Sulphide	0.001	99.99

Humidification Packing:
Rosette ring 47x19
Hpacking 1.0 m
Htotal 2.7 m
Column Dia. 0.49 m
Packing Vol. 0.19 m³
Pressure Drop 52.0 Pa

Q: 1000 m³/h
Tin: 25.0 deg C
RHin: 50.0 %



Humidifier Water Circuit:
Recirculation Rate: 2.4 m³/hr
Pump Size: 0.042 kW
Water Usage: 3.5 L/h

Bed Life: 3.0 yrs
Lime Requirements: 125 kg/m³
Total Water Use: 125 L/d
Total Wastewater Flow: 7.2 L/d

CLEANTEQ

INTERNAL APPROVAL

	APPROVED	CHECKED
NAME:	Bashar Abuusba	C. SANDOZ
SIGNATURE:	<i>[Signature]</i>	<i>[Signature]</i>
DATE:	21-8-09	21/8/09



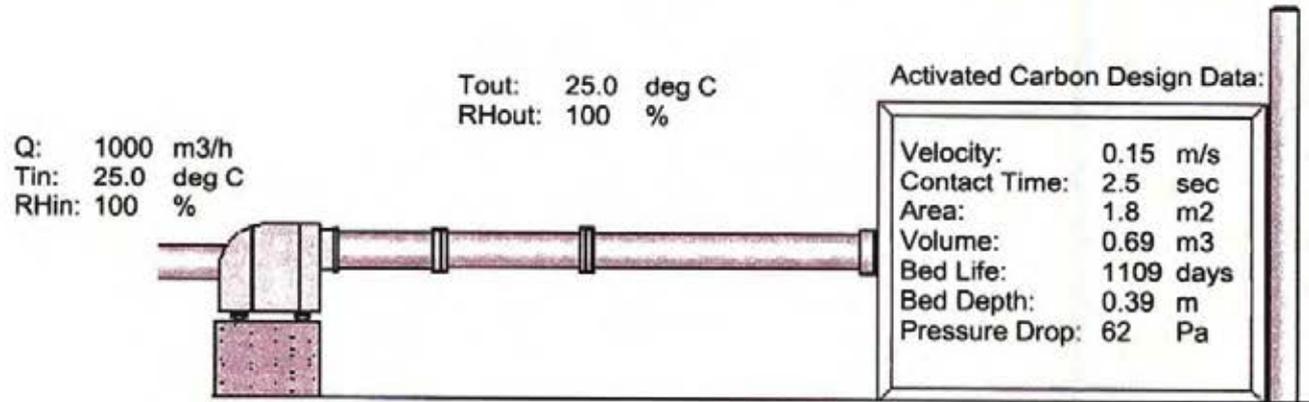
Client:
Brisbane City Council

Project:
Caswell St

Project Number: P1676
Date / Time: 14/7/2009 10:20 am

CleanCarb 2004
Design Program

Cin (ppm) 2.0000
Contaminants Hydrogen Sulphide



Fan Size: 0.35 kW

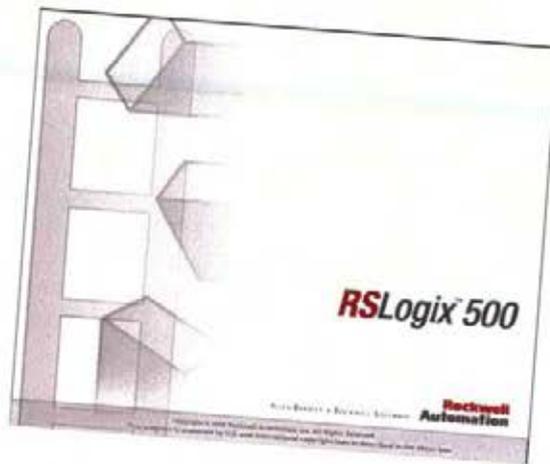
Activated Carbon Specification:
Mass of Carbon: 382 kg
Carbon Grade: 4x6 Pelletised
Carbon Density: 550 kg/m3
Carbon type: KI Impregnated Carbon

Warnings:
Design based on minimum Residence Time

CLEANTEQ <small>Water Treatment Systems</small>	
INTERNAL APPROVAL	
	APPROVED CHECKED
NAME:	Bashar Abunshah C. SANDFORD
SIGNATURE:	<i>[Signature]</i> <i>[Signature]</i>
DATE:	21.8.09 24/8/09

APPENDIX 22

RSLogix 500 Project Report



BRISBANE WATER 16_03_10

Processor Information

Processor Type: Bul.1763 MicroLogix 1100 Series B
Processor Name: BRISWAT
Total Memory Used: 232 Instruction Words Used - 81 Data Table Words Used
Total Memory Left: 6424 Instruction Words Left
Program Files: 3
Data Files: 9
Program ID: da61

BRISBANE WATER 16_03_10

I/O Configuration

Bul.1763	MicroLogix 1100 Series B
1762-IQ8OW6	8-Input 10/30 VDC 6-Output (RLY)

BRISBANE WATER 16_03_10

Channel Configuration

```
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Edit Resource/Owner Timeout: 60
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Passthru Link ID: 1
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Write Protected: No
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Comms Servicing Selection: Yes
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Message Servicing Selection: Yes
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex 1st AWA Append Character: \d
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex 2nd AWA Append Character: \a
```

```
Source ID: 1 (decimal)
Baud: 19200
Parity: NONE
Control Line : No Handshaking
Error Detection: CRC
Embedded Responses: Auto Detect
Duplicate Packet Detect: Yes
ACK Timeout(x20 ms): 50
NAK Retries: 3
ENQ Retries: 3
```

```
CHANNEL 1 (SYSTEM) - Driver: Ethernet
CHANNEL 1 (SYSTEM) - Driver: Ethernet Edit Resource/Owner Timeout: 60
CHANNEL 1 (SYSTEM) - Driver: Ethernet Passthru Link ID: 1
CHANNEL 1 (SYSTEM) - Driver: Ethernet Write Protected: No
CHANNEL 1 (SYSTEM) - Driver: Ethernet Comms Servicing Selection: Yes
CHANNEL 1 (SYSTEM) - Driver: Ethernet Message Servicing Selection: Yes
```

```
Hardware Address: 00:0F:73:01:FC:3B
IP Address: 192.168.0.11
Subnet Mask: 255.255.255.0
Gateway Address: 0.0.0.0
Msg Connection Timeout (x 1mS): 15000
Reply Timeout (x mS): 3000
Inactivity Timeout (x Min): 0
Bootp Enable: No
Dhcp Enable: No
SNMP Enable: No
HTTP Enable: Yes
Auto Negotiate Enable: Yes
Port Speed Enable: 10/100 Mbps Full Duplex/Half Duplex
Contact:
Location:
```

BRISBANE WATER 16_03_10

Program File List

Name	Number	Type	Rungs	Debug	Bytes
SYS - I]	0	SYS	0	No	0
	1	SYS	0	No	0
	2	LADDER	25	No	715

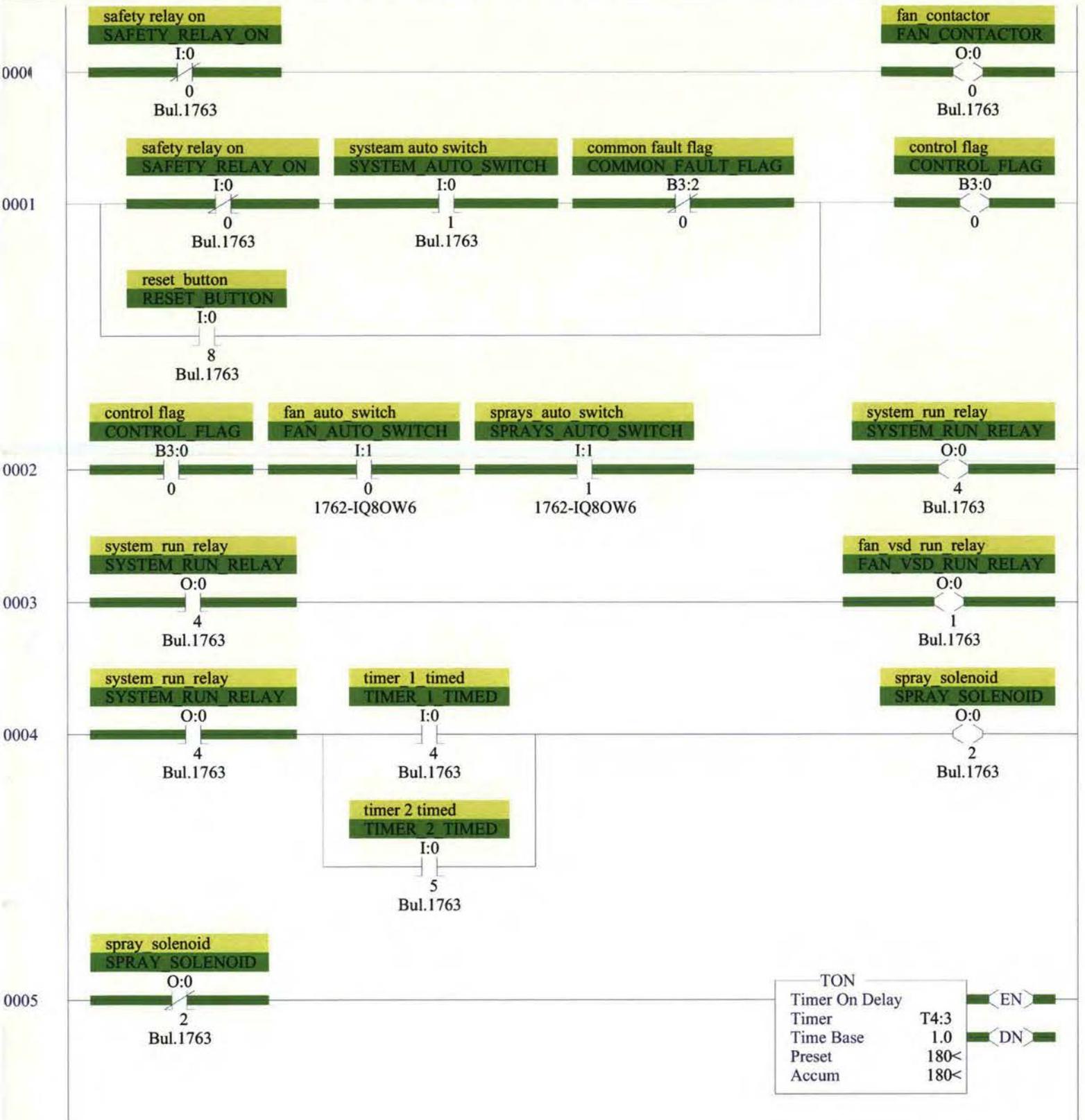
BRISBANE WATER 16_03_10

Data File List

Name	Number	Type	Scope	Debug	Words	Elements	Last
OUT	0	O	Global	No	15	5	O:4
INPUT	1	I	Global	No	21	7	I:6
STATUS	2	S	Global	No	0	66	S:65
BINARY	3	B	Global	No	3	3	B3:2
TIMER	4	T	Global	No	33	11	T4:10
COUNTER	5	C	Global	No	3	1	C5:0
CONTROL	6	R	Global	No	3	1	R6:0
INTEGER	7	N	Global	No	1	1	N7:0
FLOAT	8	F	Global	No	2	1	F8:0

BRISBANE WATER 16_03_10

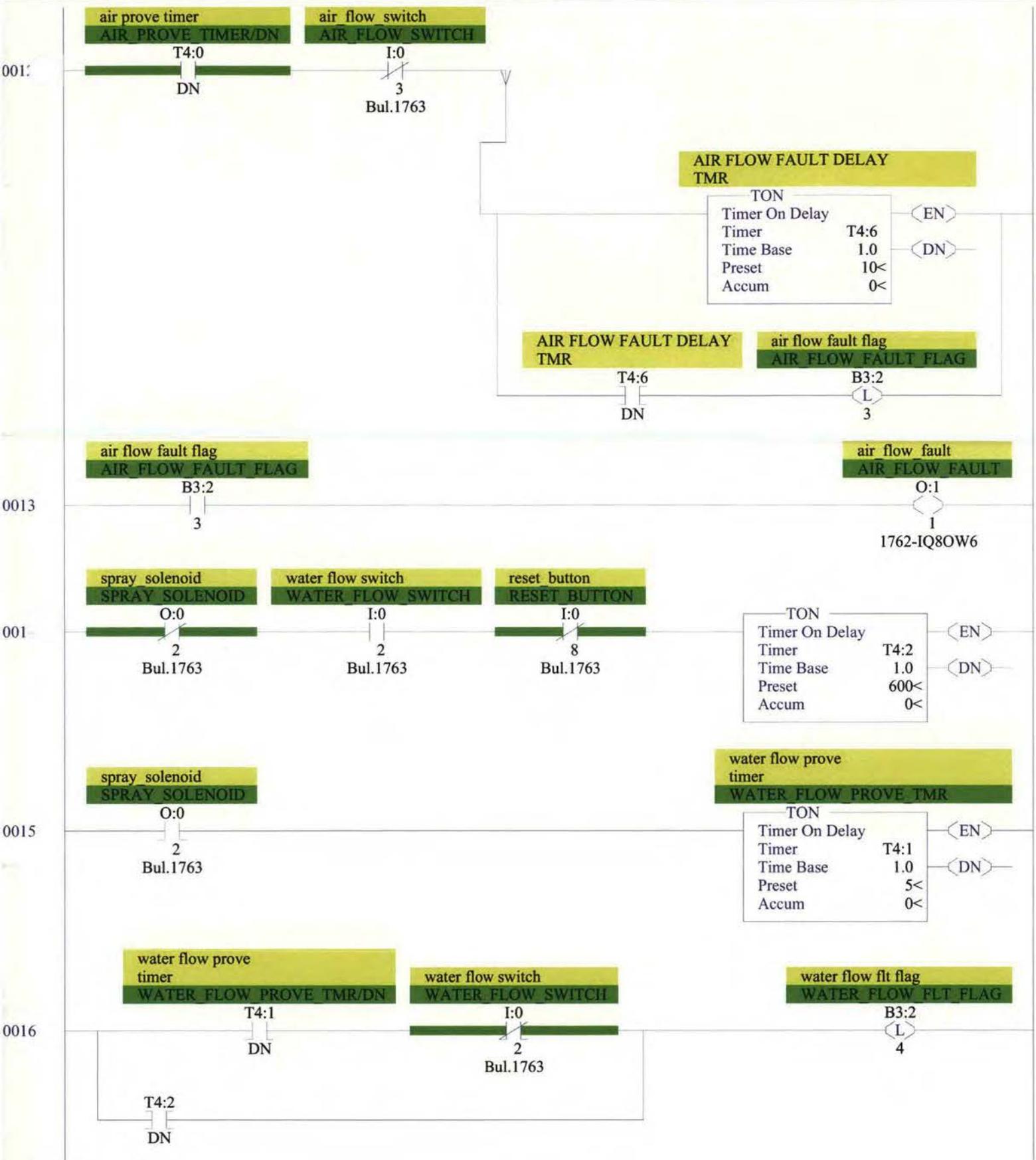
LAD 2 - --- Total Rungs in File = 25

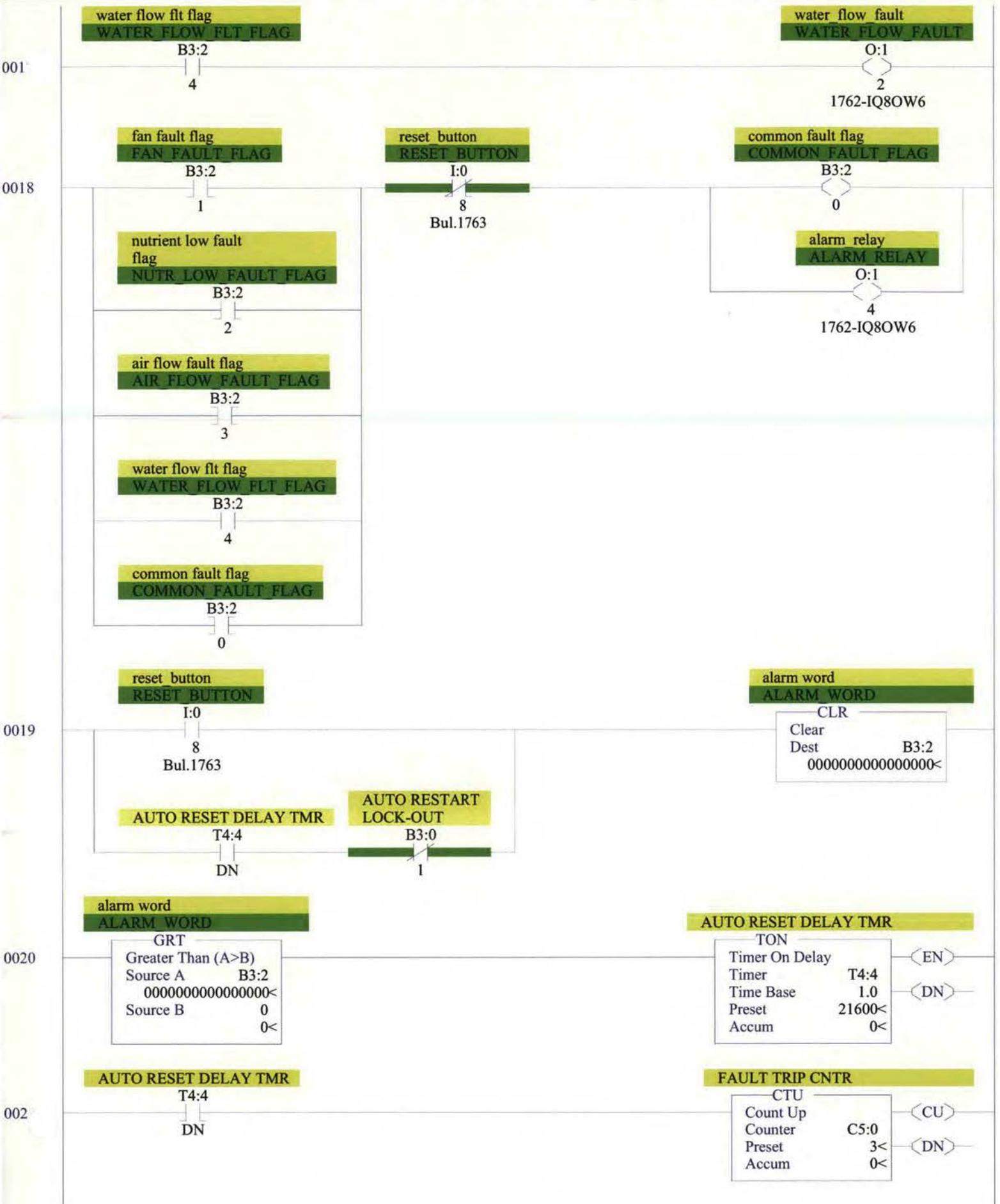


BRISBANE WATER 16_03_10

LAD 2 - --- Total Rungs in File = 25







BRISBANE WATER 16_03_10

Data File 00 (bin) -- OUTPUT

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
0:	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	Bul.1763	MicroLogix 1100 Series B
0.1:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
0.2:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
0.3:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
1.0:											0	0	0	0	0	0	1762-IQ8OW6 - 8-Input 10/30 VDC 6-Output (RLY	

BRISBANE WATER 16_03_10

Data File I1 (bin) -- INPUT

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
:0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	Bul.1763	MicroLogix 1100 Series B	
:0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B	
:0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B	
:0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B	
:0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	Bul.1763	MicroLogix 1100 Series B-Analog
:0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	Bul.1763	MicroLogix 1100 Series B-Analog	
:1.0									0	0	0	0	0	1	1	1	1762-IQ8OW6	- 8-Input 10/30 VDC 6-Output (RLY	

BRISBANE WATER 16_03_10

Data File S2 (hex) -- STATUS

main

Processor Mode S:1/0 - S:1/4 = Remote Run
 On Power up Go To Run (Mode Behavior) S:1/12 = 0
 Priority Invert S:1/15 = No
 Free Running Clock S:4 = 1000-0011-1000-1010

proc

OS Catalog Number S:57 = 1100 User Program Type S:63 = 8108h
 OS Series S:58 = B Compiler Revision Number S:64 =
 OS FRS S:59 =
 Processor Catalog Number S:60 =
 Processor Series S:61 = A
 Processor FRN S:62 =

scan Times

Maximum (x10 ms) S:22 = 26
 Watchdog (x10 ms) S:3 (high byte) = 10
 Last 100 uSec Scan Time S:35 = 7
 Scan Toggle Bit S:33/9 = 1

math

Math Overflow Selected S:2/14 = 0 Math Register (lo word) S:13 = 0
 Overflow Trap S:5/0 = 0 Math Register (high word) S:14-S:13 = 0
 Carry S:0/0 = 0 Math Register (32 Bit) S:14-S:13 = 0
 Overflow S:0/1 = 0
 Zero Bit S:0/2 = 1
 Sign Bit S:0/3 = 0

chan 0

Processor Mode S:1/0- S:1/4 = Remote Run
 Mode Address S:15 (low byte) = 0 Outgoing Msg Cmd Pending S:33/2 = 0
 Mode Address S:15 (high byte) = ?
 Channel Mode S:33/3 = 0
 Comms Active S:33/4 = 0
 Incoming Cmd Pending S:33/0 = 0
 Msg Reply Pending S:33/1 = 0

debug

Suspend Code S:7 = 0
 Suspend File S:8 = 0

errors

Fault Override At Power Up S:1/8 = 0 Fault Routine S:29 = 0
 Startup Protection Fault S:1/9 = 0 Major Error S:6 = 0h
 Major Error Halt S:1/13 = 0
 Overflow Trap S:5/0 = 0 Error Description:
 Control Register Error S:5/2 = 0
 Major Error Executing User
 Fault Rtn. S:5/3 = 0
 Battery Low S:5/11 = 0
 Input Filter Selection Modified S:5/13 = 0
 ASCII String Manipulation error S:5/15 = 0

Protection

Deny Future Access S:1/14 = No
 Data File Overwrite Protection Lost S:36/10 = False

mem Module

Memory Module Loaded On Boot S:5/8 = 0
 Password Mismatch S:5/9 = 0
 Load Memory Module On Memory Error S:1/10 = 0
 Load Memory Module Always S:1/11 = 0
 On Power up Go To Run (Mode Behavior) S:1/12 = 0
 Program Compare S:2/9 = 0
 Data File Overwrite Protection Lost S:36/10 = 0

BRISBANE WATER 16_03_10

Data File S2 (hex) -- STATUS

forces

forces Enabled S:1/5 = Yes
force Installed S:1/6 = No

BRISBANE WATER 16_03_10

Data File B3 (bin) -- BINARY

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol)	Description
3:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
3:1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
3:2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(ALARM_WORD)	alarm word

BRISBANE WATER 16_03_10

Data File T4 -- TIMER

Offset	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
'4:0	1	0	1	1.0 sec	40	40	(AIR_PROVE_TIMER) air prove timer
'4:1	0	0	0	1.0 sec	5	0	(WATER_FLOW_PROVE_TMR) water flow prove timer
'4:2	0	0	0	1.0 sec	600	0	
'4:3	1	0	1	1.0 sec	180	180	
'4:4	0	0	0	1.0 sec	21600	0	AUTO RESET DELAY TMR
'4:5	0	0	0	1.0 sec	5	0	AUTO RESTART LOCK-OUT DELAY TMR
'4:6	0	0	0	1.0 sec	10	0	AIR FLOW FAULT DELAY TMR
'4:7	0	0	0	.01 sec	0	0	
'4:8	0	0	0	.01 sec	0	0	
'4:9	0	0	0	.01 sec	0	0	
'4:10	0	0	0	.01 sec	0	0	

BRISBANE WATER 16_03_10

Data File C5 -- COUNTER

Offset	CU	CD	DN	OV	UN	UA	PRE	ACC	(Symbol)	Description
5:	0	0	0	0	0	0	3	0	FAULT	TRIP CNTR

BRISBANE WATER 16_03_10

Data File R6 -- CONTROL

Offset	EN	EU	DN	EM	ER	UL	IN	FD	LEN	POS	(Symbol)	Description
16:	0	0	0	0	0	0	0	0	0	0		

BRISBANE WATER 16_03_10

Data File N7 (dec) -- INTEGER

ffset	0	1	2	3	4	5	6	7	8	9
7:	0									

BRISBANE WATER 16_03_10

Data File F8 -- FLOAT

ffset	0	1	2	3	4
8:	0				

BRISBANE WATER 16_03_10

CDM 0 - Untitled

Address (Symbol) = Value [Description]

BRISBANE WATER 16_03_10

Address/Symbol Database

address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV
3:0/0	CONTROL_FLAG	Global	control flag			
3:0/1			AUTO RESTART LOCK-OUT			
3:2	ALARM_WORD	Global	alarm word			
3:2/1	COMMON_FAULT_FLAG	Global	common fault flag			
3:2/1	FAN_FAULT_FLAG	Global	fan fault flag			
3:2/2	NUTR_LOW_FAULT_FLAG	Global	nutrient low fault flag			
3:2/3	AIR_FLOW_FAULT_FLAG	Global	air flow fault flag			
3:2/4	WATER_FLOW_FLT_FLAG	Global	water flow flt flag			
5:0			FAULT TRIP CNTR			
:0/0	SAFETY_RELAY_ON	Global	safety relay on			
:0/1	SYSTEM_AUTO_SWITCH	Global	system auto switch			
:0/2	WATER_FLOW_SWITCH	Global	water flow switch			
:0/3	AIR_FLOW_SWITCH	Global	air_flow_switch			
:0/4	TIMER_1_TIMED	Global	timer_1_timed			
:0/5	TIMER_2_TIMED	Global	timer_2_timed			
:0/6	Q100_1_HEALTHY	Global	q100_1_healthy			
:0/7	VSD_FAULT_CONTACT	Global	vsd_fault_contact			
:0/8	RESET_BUTTON	Global	reset_button			
:0/9	LOW_NUTRIENT_LEVEL	Global	low_nutrient_level			
:1/0	FAN_AUTO_SWITCH	Global	fan_auto_switch			
:1/1	SPRAYS_AUTO_SWITCH	Global	sprays_auto_switch			
:1/2	CIRC_PUMP_AUTO_SW	Global	circ pump auto switch			
:1/3	CIRC_PUMP_MAN_SWITCH	Global	circ pump man switch			
:0/0	FAN_CONTACTOR	Global	fan_contactor			
:0/1	FAN_VSD_RUN_RELAY	Global	fan_vsd_run_relay			
:0/2	SPRAY_SOLENOID	Global	spray_solenoid			
:0/3	PUMP_RUN_RELAY	Global	pump_run_relay			
:0/4	SYSTEM_RUN_RELAY	Global	system_run_relay			
:1/0	FAN_OL_LAMP	Global	fan_ol_lamp			
:1/1	AIR_FLOW_FAULT	Global	air_flow_fault			
:1/2	WATER_FLOW_FAULT	Global	water_flow_fault			
:1/3	NUTRIENT_LOW_LEVEL	Global	nutrient_low_level			
:1/4	ALARM_RELAY	Global	alarm_relay			
:0			Arithmetic Flags			
:0/0			Processor Arithmetic Carry Flag			
:0/1			Processor Arithmetic Underflow/ Overflow Flag			
:0/2			Processor Arithmetic Zero Flag			
:0/3			Processor Arithmetic Sign Flag			
:1			Processor Mode Status/ Control			
:1/0			Processor Mode Bit 0			
:1/1			Processor Mode Bit 1			
:1/2			Processor Mode Bit 2			
:1/3			Processor Mode Bit 3			
:1/4			Processor Mode Bit 4			
:1/5			Forces Enabled			
:1/6			Forces Present			
:1/7			Comms Active			
:1/8			Fault Override at Powerup			
:1/9			Startup Protection Fault			
:1/10			Load Memory Module on Memory Error			
:1/11			Load Memory Module Always			
:1/12			Load Memory Module and RUN			
:1/13			Major Error Halted			
:1/14			Access Denied			
:1/15			First Pass			
:2/0			STI Pending			
:2/1			STI Enabled			
:2/2			STI Executing			
:2/3			Index Addressing File Range			
:2/4			Saved with Debug Single Step			
:2/5			DH-485 Incoming Command Pending			
:2/6			DH-485 Message Reply Pending			
:2/7			DH-485 Outgoing Message Command Pending			
:2/15			Comms Servicing Selection			
:3			Current Scan Time/ Watchdog Scan Time			
:4			Time Base			
:5/0			Overflow Trap			
:5/2			Control Register Error			
:5/3			Major Err Detected Executing UserFault Routine			
:5/4			M0-M1 Referenced on Disabled Slot			
:5/8			Memory Module Boot			
:5/9			Memory Module Password Mismatch			
:5/10			STI Overflow			
:5/11			Battery Low			
:6			Major Error Fault Code			
:7			Suspend Code			
:8			Suspend File			
:9			Active Nodes			
:10			Active Nodes			
:11			I/O Slot Enables			
:12			I/O Slot Enables			
:13			Math Register			
:14			Math Register			
:15			Node Address/ Baud Rate			
:16			Debug Single Step Rung			

BRISBANE WATER 16_03_10

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV
:17			Debug Single Step File			
:18			Debug Single Step Breakpoint Rung			
:19			Debug Single Step Breakpoint File			
:20			Debug Fault/ Powerdown Rung			
:21			Debug Fault/ Powerdown File			
:22			Maximum Observed Scan Time			
:23			Average Scan Time			
:24			Index Register			
:25			I/O Interrupt Pending			
:26			I/O Interrupt Pending			
:27			I/O Interrupt Enabled			
:28			I/O Interrupt Enabled			
:29			User Fault Routine File Number			
:30			STI Setpoint			
:31			STI File Number			
:32			I/O Interrupt Executing			
:33			Extended Proc Status Control Word			
:33/0			Incoming Command Pending			
:33/1			Message Reply Pending			
:33/2			Outgoing Message Command Pending			
:33/3			Selection Status User/DF1			
:33/4			Communicat Active			
:33/5			Communicat Servicing Selection			
:33/6			Message Servicing Selection Channel 0			
:33/7			Message Servicing Selection Channel 1			
:33/8			Interrupt Latency Control Flag			
:33/9			Scan Toggle Flag			
:33/10			Discrete Input Interrupt Reconfigur Flag			
:33/11			Online Edit Status			
:33/12			Online Edit Status			
:33/13			Scan Time Timebase Selection			
:33/14			DTR Control Bit			
:33/15			DTR Force Bit			
:34			Pass-thru Disabled			
:34/0			Pass-Thru Disabled Flag			
:34/1			DH+ Active Node Table Enable Flag			
:34/2			Floating Point Math Flag Disable, Fl			
:35			Last 1 ms Scan Time			
:36			Extended Minor Error Bits			
:36/8			DII Lost			
:36/16			STI Lost			
:36			Memory Module Data File Overwrite Protection			
:37			Clock Calendar Year			
:38			Clock Calendar Month			
:39			Clock Calendar Day			
:40			Clock Calendar Hours			
:41			Clock Calendar Minutes			
:42			Clock Calendar Seconds			
:43			STI Interrupt Time			
:44			I/O Event Interrupt Time			
:45			DII Interrupt Time			
:46			Discrete Input Interrupt- File Number			
:47			Discrete Input Interrupt- Slot Number			
:48			Discrete Input Interrupt- Bit Mask			
:49			Discrete Input Interrupt- Compare Value			
:50			Processor Catalog Number			
:51			Discrete Input Interrupt- Return Number			
:52			Discrete Input Interrupt- Accumulat			
:53			Reserved/ Clock Calendar Day of the Week			
:55			Last DII Scan Time			
:56			Maximum Observed DII Scan Time			
:57			Operating System Catalog Number			
:58			Operating System Series			
:59			Operating System FRN			
:61			Processor Series			
:62			Processor Revision			
:63			User Program Type			
:64			User Program Functional Index			
:65			User RAM Size			
:66			Flash EEPROM Size			
:67			Channel 0 Active Nodes			
:68			Channel 0 Active Nodes			
:69			Channel 0 Active Nodes			
:70			Channel 0 Active Nodes			
:71			Channel 0 Active Nodes			
:72			Channel 0 Active Nodes			
:73			Channel 0 Active Nodes			
:74			Channel 0 Active Nodes			
:75			Channel 0 Active Nodes			
:76			Channel 0 Active Nodes			
:77			Channel 0 Active Nodes			
:78			Channel 0 Active Nodes			
:79			Channel 0 Active Nodes			
:80			Channel 0 Active Nodes			
:81			Channel 0 Active Nodes			

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Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV
:82			Channel 0 Active Nodes			
:83			DH+ Active Nodes			
:84			DH+ Active Nodes			
:85			DH+ Active Nodes			
:86			DH+ Active Nodes			
4:0	AIR_PROVE_TIMER	Global	air prove timer			
4:1	WATER_FLOW_PROVE_TMR	Global	water flow prove timer			
4:4			AUTO RESET DELAY TMR			
4:5			AUTO RESTART LOCK-OUT DELAY TMR			
4:6			AIR FLOW FAULT DELAY TMR			

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Instruction Comment Database

Address	Instruction	Description
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Symbol Group Database

roup_Name	Description
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