The complete solution to all your cooling needs

Aqua Cooling

Incorporating Stadco Cooling

THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2015

NSCS 100-250/150/W46VCC4
NSCS 100-160/40/W45VCC4
Installation, Operating and Maintenance Manual

Client: Q Cooling
CN: CN3217

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Aqua Cooling Solutions Ltd. shall not be liable for any damages resulting from misapplication or misuse of its products.

Equipment Usage

Aqua Cooling Solutions Ltd. cannot be held responsible for personal injury or equipment damage where the product is used for anything other than its intended purpose. Safety will be impaired if the equipment is used in a manner other than that specified in this manual or on-line instructions.

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Product standards

Unless otherwise stated, products marketed and supplied by Aqua Cooling Solutions Ltd., when installed and operated in accordance with their instructions, conform to EMC directive and essential Health and Safety requirements of the Machinery Directive 91/368/EEC-93/44/EEC and 93/68/EEC.

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1 Introduction to the LPS

1.1 Introduction

This manual covers the operational procedures for the Leak Prevention System (LPS) units and is intended to be used by the following categories of people:

- Those who assess the suitability of the LPS for specific requirements.
- Those who install, configure and test the physical components of the LPS.
- Those who operate the LPS.
- Those who carry out servicing and maintenance of the LPS at the installation site.

1.2 Customer support

For technical help and support, you can contact Aqua Cooling Solutions Ltd. using any of the following details.

Aqua Cooling Solutions Ltd. contact details

Internet	www.aquacooling.co.uk
Telephone	+44 (0)845 0941 800
Fax	+44 (0)845 0941 900
Email	support@aquacooling.co.uk
Mail	Aqua Cooling Solutions Ltd. Unit D4 Segensworth Business Centre Segensworth Road Fareham Hampshire PO15 5RQ UK

To help us expedite your request, please have the following information available:

- The name and address of your organization.
- Your telephone and fax numbers.
- A contact name and e-mail address.
- The equipment model and serial numbers, which are located where?
- A description of the fault, including any relevant data, if available.

1.3 Safety notices

Note:
All personnel involved in the installation and maintenance of the equipment, whether directly or indirectly, must read this notice and this complete document prior to the commencement of any work.

Observe all warning and safety placards applied to the equipment. Failure to observe all warnings can result in serious injury or death to the operator and severe mechanical damage to the unit.

Important

Failure to comply with the manufacturer's installation instructions could affect the reliability and performance of the unit and invalidate the warranty.

Warranty is also subject to the implementation of a planned service/maintenance agreement as stipulated in the warranty booklet supplied with the unit and/or the sales contract

1.3.1 Working practices

In addition to the specific warnings contained in this manual, the following principles are considered as good working practice:

- The following information must be read, fully understood and adhered to at all times.
- The safety of you and other persons must be your main concern.
- Never carry out a task until you fully understand what you are being asked to do and how to do it safely.
- Never carry out a task you feel could be dangerous to you and other persons.
- Do not carry out any task that you are not qualified to undertake.
- Always comply with all safety rules as laid down by the relevant authorities.
- If you have any questions or concerns over the safety of you or other persons you must consult your supervisor within the company prior to the commencement of any task.
- Never start work on a unit or remove any casings, guards, doors or covers without first switching off and isolating the unit and controllers from the electrical supply.
- Make sure all rotating parts are at rest before commencement of any work on the unit.
- The safety policy of the company on whose premises the unit is installed should be read and understood by maintenance personnel.

1.3.2 General

Temperature control equipment presents mechanical, electrical, noise or vibration hazards. Observe all safety, installation, operation and maintenance instructions.

Installation, servicing and operation of the equipment can only be carried out by fully trained and technically competent personnel.

Aqua Cooling Solutions Ltd. temperature control equipment is designed to minimise mechanical and electrical hazards by fully restricting access through unit casings, doors and covers whilst equipment is operational.

Some installations may require additional protective features to prevent accidental contact with components. Aqua Cooling Solutions Ltd. can provide advice and make recommendations for additional protection to suit the application.

All installation work must be completed in accordance with the safety, installation, operation and maintenance instructions, and the unit must be correctly earthed, prior to operation.

Prior to any maintenance work being carried out, ensure that:

- Equipment is switched off.
- Equipment and controls are isolated from the electrical supply.
- All rotating parts have come to rest.

If in any doubt as to the correct interpretation of performing the safety, installation, operation and maintenance instructions, it is essential that Aqua Cooling Solutions Ltd., their agent or appointed distributor is consulted for advice and clarification.

1.3.3 Installation and handling

The installation and operation must be conducted in accordance with local regulations and accepted codes of good practice.

When moving or lifting the unit, observe caution at all times to ensure the safety of all personnel. Use only appropriate and approved lifting equipment.

Equipment and products that have been installed and commissioned by Aqua Cooling Solutions Ltd. must be maintained by, or under supervision of, technical, competent personnel and all work must be carried out in accordance with good engineering practice and strict adherence to:

- EE regulations
- Good engineering practice
- Supply authorities
- Statutory requirements
- Manufacturer's instructions and recommendations
- All other relevant information, regulations and legislation.

1.3.4 Application

The unit must be used only for the application for which it was designed.

Do not use the unit in a hazardous environment unless it has been specially designed and approved for such an application.

1.3.5 Electrical

The unit must be connected to an external isolator if one is not fitted to the unit.

Electrical connections must be carried out in accordance with national and local regulations. In the UK, standard BS 7671applies. Never make any connections in the unit circuits unless the electricity supply has been switched off at the isolators.

1.3.6 Maintenance and servicing

For information about maintenance and servicing, see “Maintenance and servicing”, on page 19.

1.3.7 Waste management

Waste materials must be disposed of in a professional and responsible manner and in strict adherence to environmental regulations. For details, consult local environmental agencies.

1.3.8 Documentation

All documentation must remain with the unit at all times.

1.3.9 Machine Directive 2006/42/EC

The machinery has been inspected against the essential health and safety requirements of the Machinery Directive relating to the design and construction, which are detailed within the six chapters of Annex I of the Directive.

A technical file that demonstrates the conformity of the machine with the Directive has been compiled and is available to the authorities on request.

The CE markings and other information have been placed on the machine, and a declaration of conformity has been supplied with the machine.

If alterations are made to this equipment without our approval, the declaration of conformity becomes invalid. Furthermore, this equipment may be assembled into other systems that may also constitute machinery and shall not be put into service until the assembled system has been declared in conformity with the Machinery Directive.

1.4 General information

Our Cooling Distribution Unit (CDU) with Leak Prevention System (LPS), is used in data centers and computer rooms, for supplying chilled water to cooling coils. The LPS enables data center cooling water pipework to operate under negative pressure. In the event of a leak or damage, water does not escape and the data center continues to operate uninterrupted until a repair can be carried out.

Traditional systems and CDUs use pumps to pump water round the water circuit, under positive pressure (greater than atmospheric). They often incorporate heat exchangers, to separate the systems into a primary and secondary system, reducing the system volume on the secondary side. They are also used to elevate the water temperatures from the primary to the secondary side, as the cooling coils often run above the dew point, thus avoiding condensation forming on the coils or the pipework.

The Aqua Cooling CDU with LPS uses a Venturi to generate a negative pressure water flow (lower than atmospheric). This means that all the data center environment and coils have water circulated through the system with a pressure that is less than the pressure in the atmosphere. In the event of a leak, air is sucked into the pipework rather than liquid being released. When air is sucked into the pipework, the water circulation carries the air back to the LPS, where the amount of air is measured and then expelled to the atmosphere.

The CDU with LPS is available in a variety of models, from 50kW to 500kW in the standard units, to multi MW platforms, through our special projects team. All are available with run and standby pumps, offering an N+1 pumping station.

1.4.1 LPS main components

The LPS series of units vary in configuration. Appendix B provides details of the main components of the standard LPS units.

1.4.2 System schematics

The standard configuration of the LPS system is shown in Schematic 1. We also offer an alternative configuration, shown in Schematic 2.

Schematic 1: Basic configuration of the LPS system

Schematic 2: Optional configuration of the LPS system

1.4.3 LPS control logic

1.4.3.1 Negative pressure and motive pump speed

The motive pump, driven by a Danfoss Inverter, regulates the speed of the pump based on the set point pressure of the system. The system pressure changes as a result of two port valves opening and closing. The pressure is set on commissioning to a value that corresponds with the design flow requirement. However, this can be changed using the microprocessor control unit. Further tuning can be applied using the PID settings, by changing a series of parameters within the Danfoss drive. This requires a Danfoss display terminal and the lock code. These changes should only be completed with specific guidance from Aqua Cooling Solutions Ltd.

1.4.3.2 Temperature control

Note:
Temperature control is available as an option for all systems.

Temperature control is achieved by means of a control valve and speed-controlled pumps.

Temperature control using a control valve can be by either a two-port, or three-port control valve. The control point used is the data center supply temperature. The control loop can be tuned using the on-board PID settings. These can be found in the control menu.

Speed-controlled pumps are used when the recirculation pumps have been selected. The amount of water being circulated around the heat exchanger is proportional to the supply temperature of water going to the data centre. One temperature probe per speed controlled pump is required in the system. The probe is wired directly to the inverter. The set point of the system can be changed using the microprocessor control. Further tuning can be applied using the PID settings, by changing a series of parameters within the Danfoss drive. This requires a Danfoss display terminal and the lock code. These changes should only be completed with specific guidance from Aqua Cooling Solutions Ltd.

Both control types are compatible with the Coldlogik Call for Help system.

1.4.3.3 Leak alarm

Air is expelled through the top of the air separator, on top of which sits an air sensor and a solenoid valve. The air sensor monitors for air. The system is programmed to purge gases periodically, because degassing does occur from the process water. The amount of air expelled is measured, to determine if there is a leak.

If a small leak occurs, the measuring and venting process can happen a few times in short succession and is alarmed as a possible leak.

If a large leak occurs, then the system can end up venting continuously. This is also alarmed and reported as a continual fault.

1.5 Water quality

We always recommend the use of glycol antifreeze solution in chilled water and cooling systems.

Note:
Refrigerant typically evaporates at 7°C below the chiller set point, so freeze risks can occur at 7°C in no-flow conditions. The correct choice of anti-freeze will give protection against costly winter freeze events, as well as aid long-term equipment life.

Our warranty does not provide cover for frost damage due to incorrect or insufficient chemical frost protection being applied.

Aqua Cooling Solutions Ltd. can provide glycol antifreeze solution, should it be required.

2 Installation

2.1 Inspection

A thorough inspection of the equipment, including all component parts and accessories, should be made immediately upon delivery. Any damage caused in transit, or missing parts, should be reported to the carrier at once. The consignee is responsible for making any claim for losses or damage.

The following sections contain a set of checklists that you can use for your convenience. The Notes column in each checklist, where blank, is for your own use, if required.

2.1.1 Inspection checklist

Item	Checked	Notes
Delivery inspection		When you take delivery of the equipment, check its condition immediately. Report any damage to the transport company at once.
Check components against shipping list		Any missing items should be reported immediately to Aqua Cooling Solutions Ltd.

2.2 Lifting instructions

The LPS is a large, heavy unit and must be handled as such. A fully qualified and properly equipped crew with necessary rigging should be engaged to set the unit in position. Bear in mind the following guidelines:

- Always keep the unit vertically upright and do not leave it out in the open.
- Before carrying out any handling operation, ensure that the lifting capacity is commensurate to the weight of the unit [refer to Table 1].
- If possible, transport the unit using a fork lift truck; otherwise use a crane with belts or cables. When you use a crane for the larger LPS units, use suitable spreader bars.
- Do not use chains on the lower part as this can cause damage to the unit.
- Avoid pressure on the top edges of the packing.
- Do not stack the units on top of each other.

Job-specific lifting plans are available on request.

2.3 Environment

Before handling and placing the unit into position a review of the most suitable location must be made. Several factors must be taken into consideration when selecting a location.

2.3.1 Installation area

The installation area must provide adequate free space around the unit, to allow for access and airflow. The following table provides the dimensions and weight of the LPS units, and the recommended minimum clearance around each side.

LPS unit dimensions

LPS	Width in (mm)	Depth in (mm)	Height in (mm)	Weight lb (kg)	Clearance in (mm)
50	31.4 (797)	49.5 (1256)	68.4 (1738)	1078 (490)	40 (1015)
100	31.4 (797)	50.4 (1280)	75.1(1908)	tba	40 (1015)
150	37.6 (956)	105.8 (2688)	63 (1600)	tba	40 (1015)
200	51.4 (1306)	127.2 (3231)	70.9(1801)	tba	40 (1015)
300	tba	tba	tba	tba	40 (1015)
400	tba	tba	tba	tb	40 (1015)
500	200.8 (5100)	66.9 (1700)	103.1 (2620)	4409 (2004)	40 (1015)

2.3.2 Environment checklist

Item	Checked	Notes
Accessibility		There should be a minimum of 40” (1.0m) free space around the perimeter of the LPS to allow for general access. Consideration should also be given to access for maintenance, for example, lifting equipment might be required if large components need to be moved.
Loading capacity of the roof, floor or deck.		Refer to the preceding installation area table of weights and dimensions.
Check that local building codes are fully satisfied.		
Effect of noise levels on adjacent buildings.		The LPS units are large mechanical units, and some noise and vibration during operation is unavoidable.
Check the location of a suitable drain for heat exchanger and pump maintenance.		
Ensure adequate provision of the cooling supply and return, and required filtration.		

2.4 Mechanical considerations

Piping practices vary considerably in accordance with local standards and regulations. When selecting and installing piping, local building and safety codes as well as regulations should be studied and complied with.

The following information should be taken as advice to prevent the unit from being damaged but it is not comprehensive:

- Design the piping carefully, paying attention to the corresponding cross sections of the pipes to avoid unnecessary pressure losses. For example, using a brine solution (glycol/water) increases the flow volume and so causes a pressure drop in the system.
- Water piping connections to the unit should be flexible. Tube compensators effectively prevent noise and vibration being transmitted between pipes and components in the system.

- Use strainer filters on the system pump section to protect the pump and hybrid coil against foreign matter.
- Design the piping so that it has a minimum number of elbows, bends and changes in elevation.

2.4.1 Mechanical schematic

TO BE SUPPLIED BY GERALD LUDGEY. IMAGE SHOULD SHOW DETAIL RELEVANT TO THE CONSIDERATIONS LISTED.

2.4.2 Mechanical checklist

Item	Checked	Notes
Provide shut-off or butterfly valves on the unit.		This enables you to carry out routine servicing without draining the system.
Install temperature and pressure gauges at the inlet and outlet of the heat exchangers.		These gauges make checking easier and can be read by non-specialists.
Include automatic air vent valves (quick-action type) at the high points of the chilled water piping.		These valves enable you to vent air from the water circuit.

2.5 Electrical requirements

2.5.1 Electrical schematic

For the electrical system details, refer to Appendix D.

2.5.2 Electrical checklist

Item	Checked	Notes
Items required		
Items required		
Items required		
Items required		
Items required		
Items required		
Items required		

2.6 Post-installation checks

MODIFY THIS LIST FOR THE LPS 500. As a final check on the installation, ensure that you perform these post-installation checks.

Item	Checked	Notes
Verify that all installation checklists have been completed.		
Ensure commissioning area is clean and safe.		
Check alignment and tightness of fastenings and fixings.		
Ensure all air intakes are free of any debris.		
Ensure all fixing screws are in place, replace where necessary.		

3 Commissioning

3.1 Introduction

The purpose of commissioning is to ensure the equipment is properly installed, there are no missing parts or components and the equipment operates correctly.

3.2 Commissioning method

The following sections specify a recommended commissioning schedule for the LPS. For further details of any step in this schedule, contact Aqua Cooling Solutions Ltd.

I THINK we need some notes on many of the items in the 3.2.x sections. Feel free to contribute!

3.2.1 Unit checklist

The following items must be checked for each LPS in your system.

Item	Checked	Notes
Conduct visual checks		
Check proper wiring of all components		In particular, check all cables and insulation for any signs of wear or damage.
Check for proper wiring to electrical panel		
Check for tightness at all terminal points		
Check earth bonding		
Turn on power, single disconnect or circuit breaker at a time, checking for proper voltage		Check mains voltage and outputs of all voltage power supplies / converters to assure correct output.
Check and record all component running currents.		

3.2.2 Control panel and microprocessor checklist

The following items must be checked for the PGDT13 Touch control panel.

Item	Checked	Notes
Check all electrical terminations.		
Check and calibrate all temperature and pressure		

measurements.		
Check and calibrate all temperature set points.		
Check correct panel operation		
Check that illuminated inputs and outputs are correct		

3.2.3 System checklist

The following items must be checked on the system.

Item	Checked	Notes
Pressure test to bypass loop..		The test can be done with gas or water.
Fill system to bypass loop..		
Flush and refill the system.		
Isolate the piping only after a preliminary leak check.		
Check pump rotations on each LPS		
Check pressure drops on the heat exchanger.		
Ensure that the water circuit has the correct pressure using either an appropriate expansion tank or pressure gauge.		
Perform a functional test.		

4

Maintenance and servicing

4.1 Introduction

Important

Failure to comply with the manufacturer's installation instructions could affect the reliability and performance of the unit and invalidate the warranty.

Warranty is also subject to the implementation of a planned service/maintenance agreement, as stipulated in the warranty booklet supplied with the unit and/or the sales contract

It is important that equipment and products which have been installed and commissioned by Aqua Cooling Solutions Ltd. are maintained by or under supervision of technical competent personnel and that all work is carried out in accordance with good engineering practice and strict adherence to the following:

- EE regulations
- Codes of good engineering practice
- Supply authorities
- Statutory requirements
- Manufacturer instructions and recommendations
- All other relevant information, regulations and legislation.

4.2 Service parts

Service parts must be of the same specification as those being renewed and should only be obtained from Aqua Cooling Solutions Ltd..

Note

The use of incorrect service parts can affect the unit operation and reliability and invalidate any warranty.

We recommend that the following spare parts be kept, as a minimum, on site for each LPSunit, to ensure continuity of operation.

Mechanical spare parts

Item	Quantity
Pump Motive	1
Bearings for motive pump	1
Seal for recirculating pump	1
Bearings set for recirculating pump	1
Solenoid -	1
Pressure Transducer -	5
Temperature Probe -	1

Vibrating Level Switch -	1
4” Dial, 3/8” Bottom Entry, 0-7 Bar/Psi	5 (optional)
4” Dial, 3/8” Bottom Entry,-1+2 Bar/Psi	2 (optional)
4” Dial, Bottom Entry, -30+60°C/F, All Stainless Steel, C/w 4” Stainless Steel Pocket	3 (optional)
Aerosol paint for skid	1

Electrical spare parts

Item	Quantity
Controller	1
20A fuse	6
40A fuse	6
4A 1-pole AC circuit breakers C curve	2
SZ standard light 14W 120V/60HZ with door-operated switch	1
6A 1-pole AC circuit breakers C curve	2
ESSENTIAL: Power supply. 5A. Input 85...264V AC. Output 24V DC	2
6A 1-pole DC circuit breakers C curve	2
24V AC/DC LED module - green	2
24V AC/DC LED module - red	2
24V AC/DC LED module - white	2
24...120V AC/DC LED module	2
15.0kW IP55 Danfoss drive	1
4.0kW IP55 Danfoss drive	1
3-position selector switch	2
Changeover relay. 2CO. 10A. 24V DC	2
NO contact block	2
WAS5 CCC 2OLP signal splitter - 4-20mA	2

4.2.1 Maintenance contracts

Please contact Aqua Cooling Solutions Ltd. for more details on preventative maintenance contracts.

Aqua Cooling Solutions Ltd. contact details

Internet	www.aquacooling.co.uk

Telephone	+44 (0)845 0941 800
Fax	+44 (0)845 0941 900
Email	support@aquacooling.co.uk
Mail	Aqua Cooling Solutions Ltd. Unit D4 Segensworth Business Centre Segensworth Road Fareham Hampshire PO15 5RQ UK

5 Warranty

Important

Failure to comply with the manufacturer's installation instructions could affect the reliability and performance of the unit and invalidate the warranty.

Warranty is also subject to the implementation of a planned service/maintenance agreement as stipulated in the warranty booklet supplied with the unit and/or the sales contract

5.1 Quality assurance

All equipment and products supplied by Aqua Cooling Solutions Ltd. are manufactured in accordance with the respective manufacturer's quality assurance program.

5.2 Warranty statement

Aqua Cooling Ltd warrants that the equipment will be free from defects for a period of 12 months from the date of start-up, or within 18 months from the date of dispatch from manufacturing facility/factory, whichever is the sooner. This is for UK Only Sites, with 12 months Parts only warranty outside the UK.

By start-up we mean the initial starting up of the equipment, which is not necessarily the same as commissioning or practical completion. When Aqua Cooling Ltd service engineers carry out the unit start-up, the warranty period is inclusive of non-consumable parts and labour. However, this cover excludes the cost of consumable items (filters, belts, refrigerant gas etc.) and any repairs or replacements required following incorrect operation of the equipment by reference to manufacturers operation and maintenance manuals. We will not replace or repair any installation work unless the installation is carried out by Aqua Cooling Ltd. We do not accept responsibility for other connected services including water supplies, condensate drains or electrical supplies. For 'Supply Only' contracts where the start-up is undertaken by others, the warranty period covers the supply only of non-consumable parts only, with labour specifically excluded.

Please note that the warranty and reliable operation is subject to a regular and professional maintenance regime throughout the life of the supplied equipment. Aqua Cooling Ltd would be pleased to offer a service and maintenance contract that is suitable for this equipment, which has the advantage of a 24 hour/365 day emergency call-out facility.

Warranty can be extended to 24 months, subject to a standard maintenance contract being entered into with Aqua Cooling Ltd within 3 months from the date of start-up. The Aqua Cooling Ltd service team undertakes to carry out all warranty work as soon as possible, Monday to Friday during normal business hours.

5.3 Warranty details

Equipment Detail:

Model Number	Serial Number	Description

The above equipment has been installed and commissioned in accordance to the manufacturer's specification on the date found below.

Commissioning Engineer's Signature: _____

Commissioning Engineer's Name (Print): _____

Date: _____

Warranty Details: 12 Months Parts Only Warranty

Warranty Start Date: _____

Warranty End Date: _____

WARRANTY

Please refer to the Limitation of the Warranty applicable to and in effect at the time of the sale/purchase of this product.

A

LPS variables

The following tables show the variables available for each LPS unit. If you have appropriate system privileges on the LPS monitor, you can edit the variables identified as read/write (R/W).

For information about editing variables, refer to **Error! Reference source not found.**, on page **Error! Bookmark not defined.**.

> **Note:**
> The variables shown shaded in grey are those visible in the PGDT13 Touch screen. Refer to **Error! Reference source not found.**, on page **Error! Bookmark not defined.**.

QUESTIONS:

1. Is there any point in documenting the variables that cannot be edited?

2. If we document non-editable variables, do you agree that it would be better for users if we separate out the editable and non-editable variables?

3. I think it would be more user friendly to organise the variables into groups relevant to the system, along the lines of how they are grouped in the user interface. If you agree, can you help me with the categories? I would envisage something like the following, with each category showing all types – integer, real, digital:

- Global/system-wide (date/time etc)
- Data center
- LPS unit groups (inlet/outlet, heat exchanger etc)

Analog variables:

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
1	Chiller_Flow_Temp_Msk	Chiller flow temperature	R	0	-99.9	99.9	°C/°F
2	Chiller_Return_Temp_Msk	Chiller return temperature	R	0	-99.9	99.9	°C/°F
3	DataCentre_Flow_Press_1_Msk	Data Centre flow pressure 1 (2dec)	R	0	-1000	1000	BAR/PSI
4	DataCentre_Flow_Press_2_Msk	Data center flow pressure 2 (2dec)	R	0	-1000	1000	BAR/PSI
5	DataCentre_Flow_Temp_Msk	Data center flow temperature	R	0	-99.9	99.9	°C/°F
6	DataCentre_Return_Temp_Msk	Data center return temperature	R	0	-99.9	99.9	°C/°F
7	Negative_Suction_Press_1_Msk	Negative suction pressure 1	R	0	-99.9	99.9	BAR/PSI
8	Negative_Suction_Press_2_Msk	Negative suction pressure 2	R	0	-99.9	99.9	BAR/PSI
9	Tank_Level	Tank level	R	0	-99.9	99.9	meters
10	VenturiInletPress_Msk	Venturi inlet pressure (2dec)	R	0	-1000	1000	BAR/PSI
11	Temp_SPRB_1_Msk	Temperature value read by the probe	R	0	-50	100	°C/°F
12	Hum_SPRB_1	Humidity value read by the probe	R	0	0	100	---
13	DewP_SPRB_1_Msk	Dew point value	R	0	-50	200	°C/°F
14	One_Seg_Ago_Flow	Data center flow temperature 1 seg ago	R	0	-99.9	99.9	BAR

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
15	Delta_Flow	Data flow	R	0	-99.9	99.9	BAR
16	Flowrate_litre_sec	Flow in litre/s	R	0	0	99.9	Litre/sec
17	Flowrate_m3_hr	Flowrate in m3/h	R	0	0	99.9	m3/hr
18	Flowrate_mask	Flowrate shown on mask	R	0	0	99.9	m3/hr
19	DataCentre_Flow_Press_1_LL	Data center flow pressure decimal part	R	0	0	99	BAR
20	DataCentre_Flow_Press_1_HH	Data center flow pressure integer part	R	0	0	99	BAR
21	HeatExchanger_RegValue	Heat Exchanger Reg Value	R	0	-3276.8	3276.7	°C
22	SetP1_HeatExchanger_Msk	Setpoint heat exchanger	R/W	100	-32	210.2	°C/°F
23	HeatExchanger_Diff_Msk	Heat exchanger Differential	R/W	0	-99.9	99.9	°C/°F
24	HeatExchanger_VMax	Heat Exchanger voltage max	R/W	9	0	10	V
25	HeatExchanger_VMin	Heat Exchanger Voltage min	R/W	1	0	10	V
26	HeatExchanger_Req	Heat Exchanger Request	R	0	0	100	%
27	DataCentre_Flow_Press_2_LL	Data center flow pressure 2 decimal part	R	0	0	99	BAR
28	DataCentre_Flow_Press_2_HH	Data center flow pressure 2 integer part	R	0	0	99	BAR
29	VenturiInletPress_LL	Venturi inlet pressure decimal part	R	0	0	99	BAR
30	VenturiInletPress_HH	Venturi inlet pressure integer part	R	0	0	99	BAR

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
31	InverterPumps_RegValue_Msk	Inverter Pumps Reg Value	R	0	-3276.8	3276.7	BAR/PSI
32	InverterPumps_SetP_Msk	Inverter pumps Setpoint on BMS (2dec)	R/W	99.9	-999	999	BAR/PSI
33	InverterPumps_Diff_Msk	Inverter pumps differential on BMS (2dec)	R/W	100	0	725	BAR/PSI
34	InverterPumps_MinPress_Msk	Inverter pumps min pressure (2dec)	R/W	100	-999.9	999.9	BAR/PSI
35	InverterPumps_Req	Inverter Pumps Request	R	0	-3276.8	3276.7	%
36	SetP2_HeatExchanger_Msk	Setpoint 2 heat exchanger	R/W	100	-32	210.2	°C/°F
37	SetP_Actv_HeatExchanger_Msk	Setpoint active heat exchanger	R	100	-32	210.2	°C/°F
41	NegativeValve_RegValue_Msk	Negative Valve Reg Value	R	0	-3276.8	3276.7	BAR/PSI
42	NegativeValve_SetP_Msk	Offset Venturi inlet pressure (2dec)	R/W	0	-72.5	72.5	BAR/PSI
43	NegativeValve_Diff_Msk	Negative valve differential on BMS (2dec)	R/W	99.9	0	72.5	BAR/PSI
44	NegativeValve_VMax	Negative Valve Voltage max	R/W	9	0	10	V
45	NegativeValve_VMin	Negative Valve Voltage min	R/W	0.5	0	10	V
46	NegativeValve_Req	Negative pressure Request	R	0	0	100	%
51	B01_Offset_Msk	Offset Negative suction press. 1	R/W	0	-99.9	99.9	BAR/PSI
52	B02_Offset_Msk	Offset Negative suction press. 2	R/W	0	-99.9	99.9	BAR/PSI
53	B03_Offset_Msk	Offset Venturi inlet pressure	R/W	0	-99.9	99.9	BAR/PSI

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
54	B04_Offset_Msk	Offset Chiller flow temperature	R/W	0	-99.9	99.9	°C/°F
55	B05_Offset_Msk	Offset Chiller return temperature	R/W	0	-99.9	99.9	°C/°F
56	B06_Offset_Msk	Offset Data center flow press. 1	R/W	0	-99.9	99.9	BAR/PSI
57	B07_Offset_Msk	Offset Data center flow press. 2	R/W	0	-99.9	99.9	BAR/PSI
58	B08_Offset	Offset Tank level	R/W	0	-99.9	99.9	meters
59	B09_Offset_Msk	Offset Data center return temp.	R/W	0	-99.9	99.9	°C/°F
60	B10_Offset_Msk	Offset Data center flow temp.	R/W	0	-99.9	99.9	°C/°F
71	B01_Alarm_High_Thr_Msk	Al. high threshold Negative suction press. 1	R/W	0	-999.9	999.9	BAR/PSI
72	B01_Alarm_Low_Thr_Msk	Al. low threshold Negative suction press. 1	R/W	0	-999.9	999.9	BAR/PSI
73	B02_Alarm_High_Thr_Msk	Al. high threshold Negative suction press. 2	R/W	0	-999.9	999.9	BAR/PSI
74	B02_Alarm_Low_Thr_Msk	Al. low threshold Negative suction press. 2	R/W	0	-999.9	999.9	BAR/PSI
75	B03_Alarm_High_Thr_Msk	Al. high threshold Venturi inlet press.	R/W	0	-999.9	999.9	BAR/PSI
76	B03_Alarm_Low_Thr_Msk	Al. low threshold Venturi inlet press.	R/W	0	-999.9	999.9	BAR/PSI
77	B04_Alarm_High_Thr_Msk	Al. high threshold Chiller flow temperature	R/W	0	-999.9	999.9	°C/°F
78	B04_Alarm_Low_Thr_Msk	Al. low threshold Chiller flow temperature	R/W	0	-999.9	999.9	°C/°F
79	B05_Alarm_High_Thr_Msk	Al. high threshold Chiller return temperature	R/W	0	-999.9	999.9	°C/°F

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
80	B05_Alarm_Low_Thr_Msk	Al. low threshold Chiller return temperature	R/W	0	-999.9	999.9	°C/°F
81	B06_Alarm_High_Thr_Msk	Al. high threshold Data center flow press. 1	R/W	0	-999.9	999.9	BAR/PSI
82	B06_Alarm_Low_Thr_Msk	Al. low threshold Data center flow press. 1	R/W	0	-999.9	999.9	BAR/PSI
83	B07_Alarm_High_Thr_Msk	Al. high threshold Data center flow press. 2	R/W	0	-999.9	999.9	BAR/PSI
84	B07_Alarm_Low_Thr_Msk	Al. low threshold Data center flow press. 2	R/W	0	-999.9	999.9	BAR/PSI
85	B08_Alarm_High_Thr	Al. high threshold Tank level	R/W	1.5	-999.9	999.9	meters
86	B08_Alarm_Low_Thr	Al. low threshold Tank level	R/W	0.2	-999.9	999.9	meters
87	B09_Alarm_High_Thr_Msk	Al. high threshold Data center return temp.	R/W	0	-999.9	999.9	°C/°F
88	B09_Alarm_Low_Thr_Msk	Al. low threshold Data center return temp.	R/W	0	-999.9	999.9	°C/°F
89	B10_Alarm_High_Thr_Msk	Al. high threshold Data center flow temp.	R/W	0	-999.9	999.9	°C/°F
90	B10_Alarm_Low_Thr_Msk	Al. low threshold Data center flow temp.	R/W	0	-999.9	999.9	°C/°F
101	Min_Reference_VLT_1	Min Reference Pump 1	R	0	-3276.8	3276.7	---
102	Motor_Current_Inv_1	Motor Current Pump 1	R	0	-3276.8	3276.7	---
103	Motor_Frequency_Inv_1	Motor Frequency Pump 1	R	0	-3276.8	3276.7	---
104	Motor_Power_HP_VLT_1	Motor Power HP Pump 1	R	0	-3276.8	3276.7	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
105	Motor_Power_kW_Inv_1	Motor Power kW Pump 1	R	0	-3276.8	3276.7	---
106	Motor_Torque_Nm_Inv_1	Motor Torque Nm Pump 1	R	0	-3276.8	3276.7	---
107	Motor_Voltage_Inv_1	Motor Voltage Pump 1	R	0	-3276.8	3276.7	---
108	Ramp1_Dw_Time_VLT_1	Ramp1 Dw Time Pump 1	R	0	-3276.8	3276.7	---
109	Ramp1_Up_Time_VLT_1	Ramp1 Up Time Pump 1	R	0	-3276.8	3276.7	---
110	Reference_0_1000_VLT_1	Reference Pump 1	R	0	0	100	---
111	Max_Reference_VLT_1	Max Reference Pump 1	R	0	-3276.8	3276.7	---
112	DC_Link_Voltage_Inv_1	DC Link Voltage Pump 1	R	0	-3276.8	3276.7	---
126	Min_Reference_VLT_2	Min Reference Pump 2	R	0	-3276.8	3276.7	---
127	Motor_Current_Inv_2	Motor Current Pump 2	R	0	-3276.8	3276.7	---
128	Motor_Frequency_Inv_2	Motor Frequency Pump 2	R	0	-3276.8	3276.7	---
129	Motor_Power_HP_VLT_2	Motor Power HP Pump 2	R	0	-3276.8	3276.7	---
130	Motor_Power_kW_Inv_2	Motor Power kW Pump 2	R	0	-3276.8	3276.7	---
131	Motor_Torque_Nm_Inv_2	Motor Torque Nm Pump 2	R	0	-3276.8	3276.7	---
132	Motor_Voltage_Inv_2	Motor Voltage Pump 2	R	0	-3276.8	3276.7	---
133	Ramp1_Dw_Time_VLT_2	Ramp1 Dw Time Pump 2	R	0	-3276.8	3276.7	---
134	Ramp1_Up_Time_VLT_2	Ramp1 Up Time Pump 2	R	0	-3276.8	3276.7	---
135	Reference_0_1000_VLT_2	Reference Pump 2	R	0	0	100	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
136	Max_Reference_VLT_2	Max Reference Pump 2	R	0	-3276.8	3276.7	---
137	DC_Link_Voltage_Inv_2	DC Link Voltage Pump 2	R	0	-3276.8	3276.7	---
151	Min_Reference_VLT_3	Min Reference Inv 3	R	0	-3276.8	3276.7	---
152	Motor_Current_VLT_3		R	0	-3276.8	3276.7	---
153	Motor_Frequency_VLT_3		R	0	-3276.8	3276.7	---
154	Motor_Power_HP_VLT_3	Motor Power HP Inv 3	R	0	-3276.8	3276.7	---
155	Motor_Power_kW_VLT_3		R	0	-3276.8	3276.7	---
156	Motor_Torque_Nm_VLT_3		R	0	-3276.8	3276.7	---
157	Motor_Voltage_VLT_3		R	0	-3276.8	3276.7	---
158	Ramp1_Dw_Time_VLT_3	Ramp1 Dw Time Inv 3	R/W	0	-3276.8	3276.7	---
159	Ramp1_Up_Time_VLT_3	Ramp1 Up Time Inv 3	R	0	-3276.8	3276.7	---
160	Reference_0_1000_VLT_3	Reference Inv 3	R	0	0	100	---
161	Max_Reference_VLT_3	Max Reference Inv 3	R	0	-3276.8	3276.7	---
162	DC_Link_Voltage_VLT_3		R	0	-3276.8	3276.7	---
176	Min_Reference_VLT_4	Min Reference Inv 4	R	0	-3276.8	3276.7	---
177	Motor_Current_VLT_4		R	0	-3276.8	3276.7	---
178	Motor_Frequency_VLT_4		R	0	-3276.8	3276.7	---
179	Motor_Power_HP_VLT_4	Motor Power HP Inv 4	R	0	-3276.8	3276.7	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
180	Motor_Power_kW_VLT_4		R	0	-3276.8	3276.7	---
181	Motor_Torque_Nm_VLT_4		R	0	-3276.8	3276.7	---
182	Motor_Voltage_VLT_4		R	0	-3276.8	3276.7	---
183	Ramp1_Dw_Time_VLT_4	Ramp1 Dw Time Inv 4	R/W	0	-3276.8	3276.7	---
184	Ramp1_Up_Time_VLT_4	Ramp1 Up Time Inv 4	R	0	-3276.8	3276.7	---
185	Reference_0_1000_VLT_4	Reference Inv 4	R	0	0	100	---
186	Max_Reference_VLT_4	Max Reference Inv 4	R	0	-3276.8	3276.7	---
187	DC_Link_Voltage_VLT_4		R	0	-3276.8	3276.7	---

Integer variables:

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
1	BMS_Sw_Ver	Software version (BMS syntax)	R	15018	0	32767	---
2	BMS_Sw_Date	Software date (BMS syntax)	R	15018	0	32767	---
3	Unit_Status	Unit Status (0:Waiting 1:Unit ON 2:OFFbyALR 3:OFFbyNET 4:OFFbyBMS 5:OFFbySCH 6:OFFbyDIN 7:OFFbyKey 8:Manual)	R	0	0	13	num
4	Pump1_Mode	(0:OnOff 1:Danfoss 2:ABB)	R	0	0	2	num
5	Pump2_Mode	(0:OnOff 1:Danfoss 2:ABB)	R	0	0	2	num
12	Air_Release_Req_Max_Dur	Air release valve count requests timeout	R/W	60	0	999	sec

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
	ation						
13	Air_Release_Req_Max_Times	Air release valve max number of times	R/W	3	0	9	num
14	Air_Release_Req_Time	Air release valve request duration	R/W	10	0	999	sec
16	LeakLevel_Delay	Leak level alarm delay	R/W	300	0	9999	sec
17	DelayStartup_FlowAlarm	Delay activating Flow Alarm at pump startup	R/W	15	1	999	sec
18	DelayRun_FlowAlarm	Max time of presence/absence of flow - If flow is absent longer generates a warning - If flow is present longer (after no water flow alarm) it resets warnings counter	R/W	15	1	999	sec
21	HeatExchanger_Der_Time	Heat exchanger Derivate Time	R/W	0	0	999	sec
22	HeatExchanger_Int_Time	Heat exchanger Integral Time	R/W	300	0	999	sec
31	InverterPumps_Der_Time	Inverter pumps Derivative Time	R/W	0	0	999	sec
32	InverterPumps_Int_Time	Inverter pumps Integral Time	R/W	300	0	999	sec
33	InverterPumps_MinPress_Delay	Inverter Pumps Min Press Delay	R/W	15	0	999	sec
34	Pump_Num	Inverter Pumps number	R/W	2	0	2	num
35	InverterPumps_Rot_Hour	Inverter pumps rotation hour	R/W	9	0	23	h
36	InverterPumps_Rot_Minute	Inverter pumps rotation minute	R/W	30	0	59	min
37	InverterPumps_Rot_Weekda	(0:None 1:Mon 2:Tue 3:Wed 4:Thr 5:Frid	R/W	1	0	7	num

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
	y	6:Sat 7:Sun)					
41	NegativeValve_Der_Time	Negative pressure Derivative Time	R/W	0	0	999	sec
42	NegativeValve_Int_Time	Negative pressure Integral Time	R/W	300	0	999	sec
51	LeakDetection_Delay	Leak Detection Delay	R/W	5	0	9999	s
61	CURRENT_HOUR	Current hour	R	0	0	23	h
62	CURRENT_MINUTE	Current minute	R	0	0	59	---
63	CURRENT_DAY	Current day	R	1	1	31	---
64	CURRENT_MONTH	Current month	R	1	1	12	---
65	CURRENT_YEAR	Current year	R	0	0	99	---
66	CURRENT_WEEKDAY	Current weekday	R	1	1	7	W
101	Alarm_Word_1_VLT_1	Alarm Word 1 Pump 1	R	0	-32768	32767	---
102	Alarm_Word_2_VLT_1	Alarm Word 2 Pump 1	R	0	-32768	32767	---
103	Control_Card_Temp_VLT_1	Control Card Temp Pump 1	R	0	-32768	32767	°C
104	Heatsink_Temp_VLT_1	Heatsink Temp Pump 1	R	0	-32768	32767	°C
105	kWh_Counter_VLT_1	kWh Counter Pump 1	R	0	-32768	32767	KWh
106	Main_Actual_Value_VLT_1	Main Actual Value Pump 1	R	0	-32768	32767	---
107	Motor_Speed_rpm_VLT_1	Motor Speed rpm Pump 1	R	0	-32768	32767	rpm
108	NumStarts_Counter_VLT_1	NumStarts Counter Pump 1	R	0	-32768	32767	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
109	Operation_Hours_VLT_1	Operation Hours Pump 1	R	0	-32768	32767	h
110	OverTemps_Counter_VLT_1	OverTemps Counter Pump 1	R	0	-32768	32767	---
111	OverVoltage_Counter_VLT_1	OverVoltage Counter Pump 1	R	0	-32768	32767	---
112	PowerUps_Counter_VLT_1	PowerUps Counter Pump 1	R	0	-32768	32767	---
113	Running_Hours_VLT_1	Running Hours Pump 1	R	0	-32768	32767	h
114	Speed_H_Limit_Hz_VLT_1	Speed H Limit Hz Pump 1	R	0	-32768	32767	Hz
115	Speed_H_Limit_rpm_VLT_1	Speed H Limit rpm Pump 1	R	0	-32768	32767	rpm
116	Speed_L_Limit_Hz_VLT_1	Speed L Limit Hz Pump 1	R	0	-32768	32767	Hz
117	Speed_L_Limit_rpm_VLT_1	Speed L Limit rpm Pump 1	R	0	-32768	32767	rpm
118	Status_Word_VLT_1	Status Word Pump 1	R	0	-32768	32767	---
119	Warning_Word_1_VLT_1	Warning Word 1 Pump 1	R	0	-32768	32767	---
120	Warning_Word_2_VLT_1	Warning Word 2 Pump 1	R	0	-32768	32767	---
126	Alarm_Word_1_VLT_2	Alarm Word 1 Pump 2	R	0	-32768	32767	---
127	Alarm_Word_2_VLT_2	Alarm Word 2 Pump 2	R	0	-32768	32767	---
128	Control_Card_Temp_VLT_2	Control Card Temp Pump 2	R	0	-32768	32767	°C
129	Heatsink_Temp_VLT_2	Heatsink Temp Pump 2	R	0	-32768	32767	°C
130	kWh_Counter_VLT_2	kWh Counter Pump 2	R	0	-32768	32767	KWh

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
131	Main_Actual_Value_VLT_2	Main Actual Value Pump 2	R	0	-32768	32767	---
132	Motor_Speed_rpm_VLT_2	Motor Speed rpm Pump 2	R	0	-32768	32767	rpm
133	NumStarts_Counter_VLT_2	NumStarts Counter Pump 2	R	0	-32768	32767	---
134	Operation_Hours_VLT_2	Operation Hours Pump 2	R	0	-32768	32767	h
135	OverTemps_Counter_VLT_2	OverTemps Counter Pump 2	R	0	-32768	32767	---
136	OverVoltage_Counter_VLT_2	OverVoltage Counter Pump 2	R	0	-32768	32767	---
137	PowerUps_Counter_VLT_2	PowerUps Counter Pump 2	R	0	-32768	32767	---
138	Running_Hours_VLT_2	Running Hours Pump 2	R	0	-32768	32767	h
139	Speed_H_Limit_Hz_VLT_2	Speed H Limit Hz Pump 2	R	0	-32768	32767	Hz
140	Speed_H_Limit_rpm_VLT_2	Speed H Limit rpm Pump 2	R	0	-32768	32767	rpm
141	Speed_L_Limit_Hz_VLT_2	Speed L Limit Hz Pump 2	R	0	-32768	32767	Hz
142	Speed_L_Limit_rpm_VLT_2	Speed L Limit rpm Pump 2	R	0	-32768	32767	rpm
143	Status_Word_VLT_2	Status Word Pump 2	R	0	-32768	32767	---
144	Warning_Word_1_VLT_2	Warning Word 1 Pump 2	R	0	-32768	32767	---
145	Warning_Word_2_VLT_2	Warning Word 2 Pump 2	R	0	-32768	32767	---
151	Alarm_Word_1_VLT_3	Alarm Word 1 Inv 3	R	0	-32768	32767	---
152	Alarm_Word_2_VLT_3	Alarm Word 2 Inv 3	R	0	-32768	32767	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
153	Control_Card_Temp_VLT_3	Control Card Temp Inv 3	R	0	-32768	32767	°C
154	Heatsink_Temp_VLT_3	Heatsink Temp Inv 2	R	0	-32768	32767	°C
155	kWh_Counter_VLT_3	kWh Counter Inverter 3	R	0	-32768	32767	KWh
156	Main_Actual_Value_VLT_3	Main Actual Value Inv 3	R	0	-32768	32767	---
157	Motor_Speed_rpm_VLT_3	Motor Speed rpm Inv 3	R	0	-32768	32767	rpm
158	NumStarts_Counter_VLT_3	NumStarts Counter Inv 3	R	0	-32768	32767	---
159	Operation_Hours_VLT_3	Operation Hours Inverter 3	R	0	-32768	32767	h
160	OverTemps_Counter_VLT_3	OverTemps Counter Inv 3	R	0	-32768	32767	---
161	OverVoltage_Counter_VLT_3	OverVoltage Counter Inv 3	R	0	-32768	32767	---
162	PowerUps_Counter_VLT_3	PowerUps Counter Inv 3	R	0	-32768	32767	---
163	Running_Hours_VLT_3	Running Hours Inverter 2	R	0	-32768	32767	h
164	Speed_H_Limit_Hz_VLT_3	Speed H Limit Hz Inverter 3	R	0	-32768	32767	Hz
165	Speed_H_Limit_rpm_VLT_3	Speed H Limit rpm Inverter 3	R	0	-32768	32767	rpm
166	Speed_L_Limit_Hz_VLT_3	Speed L Limit Hz Inv 3	R	0	-32768	32767	Hz
167	Speed_L_Limit_rpm_VLT_3	Speed L Limit rpm Inv 3	R	0	-32768	32767	rpm
168	Status_Word_VLT_3	Status Word Inv 3	R	0	-32768	32767	---
169	Warning_Word_1_VLT_3	Warning Word 1 Inv 3	R	0	-32768	32767	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
170	Warning_Word_2_VLT_3	Warning Word 2 Inv 3	R	0	-32768	32767	---
176	Alarm_Word_1_VLT_4	Alarm Word 1 Inv 4	R	0	-32768	32767	---
177	Alarm_Word_2_VLT_4	Alarm Word 2 Inv 4	R	0	-32768	32767	---
178	Control_Card_Temp_VLT_4	Control Card Temp Inv 4	R	0	-32768	32767	°C
179	Heatsink_Temp_VLT_4	Heatsink Temp Inv 4	R	0	-32768	32767	°C
180	kWh_Counter_VLT_4	kWh Counter Inverter 4	R	0	-32768	32767	KWh
181	Main_Actual_Value_VLT_4	Main Actual Value Inv 4	R	0	-32768	32767	---
182	Motor_Speed_rpm_VLT_4	Motor Speed rpm Inv 4	R	0	-32768	32767	rpm
183	NumStarts_Counter_VLT_4	NumStarts Counter Inv 4	R	0	-32768	32767	---
184	Operation_Hours_VLT_4	Operation Hours Inverter 4	R	0	-32768	32767	h
185	OverTemps_Counter_VLT_4	OverTemps Counter Inv 4	R	0	-32768	32767	---
186	OverVoltage_Counter_VLT_4	OverVoltage Counter Inv 4	R	0	-32768	32767	---
187	PowerUps_Counter_VLT_4	PowerUps Counter Inv 4	R	0	-32768	32767	---
188	Running_Hours_VLT_4	Running Hours Inverter 4	R	0	-32768	32767	h
189	Speed_H_Limit_Hz_VLT_4	Speed H Limit Hz Inverter 4	R	0	-32768	32767	Hz
190	Speed_H_Limit_rpm_VLT_4	Speed H Limit rpm Inverter 4	R	0	-32768	32767	rpm
191	Speed_L_Limit_Hz_VLT_4	Speed L Limit Hz Inv 4	R	0	-32768	32767	Hz

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
192	Speed_L_Limit_rpm_VLT_4	Speed L Limit rpm Inv 4	R	0	-32768	32767	rpm
193	Status_Word_VLT_4	Status Word Inv 4	R	0	-32768	32767	---
194	Warning_Word_1_VLT_4	Warning Word 1 Inv 4	R	0	-32768	32767	---
195	Warning_Word_2_VLT_4	Warning Word 2 Inv 4	R	0	-32768	32767	---

Logical variables:

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
1	Sys_On	On-Off unit state (0: Off; 1: On)	R	0	0	1	---
4	AI_Probe_01	When equal to 1,there is probe alarm generate.	R	0	0	1	---
5	AI_Probe_02	When equal to 1,there is probe alarm generate.	R	0	0	1	---
6	AI_Probe_03	When equal to 1,there is probe alarm generate.	R	0	0	1	---
7	AI_Probe_04	When equal to 1,there is probe alarm generate.	R	0	0	1	---
8	AI_probe_05	When equal to 1,there is probe alarm generate.	R	0	0	1	---
9	AI_Probe_06	When equal to 1,there is probe alarm generate.	R	0	0	1	---
10	AI_Probe_07	When equal to 1,there is probe alarm	R	0	0	1	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
		generate.					
11	AI_Probe_08	When equal to 1,there is probe alarm generate.	R	0	0	1	---
12	AI_Probe_09	When equal to 1,there is probe alarm generate.	R	0	0	1	---
13	AI_probe_10	When equal to 1,there is probe alarm generate.	R	0	0	1	---
14	AI_Low_B01	AI. low level Negative suction press. 1	R	0	0	1	---
15	AI_Low_B02	AI. low level Negative suction press. 2	R	0	0	1	---
16	AI_Low_B03	AI. low level Venturi inlet pressure	R	0	0	1	---
17	AI_Low_B04	AI. low level Chiller flow temperature	R	0	0	1	---
18	AI_Low_B05	AI. low level Chiller return temperature	R	0	0	1	---
19	AI_Low_B06	AI. low level Data Centre flow press. 1	R	0	0	1	---
20	AI_Low_B07	AI. low level Data Centre flow press. 2	R	0	0	1	---
21	AI_Low_B08	AI. low level Tank level	R	0	0	1	---
22	AI_Low_B09	AI. low level Data Centre return temp.	R	0	0	1	---
23	AI_Low_B10	AI. low level Data Centre flow temp.	R	0	0	1	---
24	AI_High_B01	AI. high level Negative suction press. 1	R	0	0	1	---
25	AI_High_B02	AI. high level Negative suction press. 2	R	0	0	1	---
26	AI_High_B03	AI. high level Venturi inlet pressure	R	0	0	1	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
27	AI_High_B04	AI. high level Chiller flow temperature	R	0	0	1	---
28	AI_High_B05	AI. high level Chiller return temperature	R	0	0	1	---
29	AI_High_B06	AI. high level Data Centre flow press. 1	R	0	0	1	---
30	AI_High_B07	AI. high level Data Centre flow press. 2	R	0	0	1	---
31	AI_High_B08	AI. high level Tank level	R	0	0	1	---
32	AI_High_B09	AI. high level Data Centre return temp.	R	0	0	1	---
33	AI_High_B10	AI. high level Data Centre flow temp.	R	0	0	1	---
34	AI_Pump1_Bus_ok	AI. pump 1 bus ok	R	0	0	1	---
35	AI_Pump1_Fault	AI. pump 1 fault	R	0	0	1	---
38	AI_Possible_Leak	AI. possible leak	R	0	0	1	---
39	AI_LeakDetection	AI. Leak Detection	R	0	0	1	---
40	AI_Config_In1	AI. config dig. input 1	R	0	0	1	---
41	AI_Config_In2	AI. config dig. input 2	R	0	0	1	---
42	AI_Config_In3	AI. config dig. input 3	R	0	0	1	---
45	AI_Offline_pCOe	Offline alarm - pCOe	R	0	0	1	---
47	AI_Offline_VLT_1	AI. Offline Inverter 1	R	0	0	1	---
49	AI_Offline_VLT_3	AI. Offline Inverter 3	R	0	0	1	---
51	Pump1_OnOff_Enable	On/Off Pump1 enable	R	0	0	1	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
53	Pump1_Enable	Pump1 Enable	R	0	0	1	---
55	Pump1_OnOff_On	On/Off Pump1 Request	R	0	0	1	---
57	DataCentre_Flow_Press_1_ Positive	Data Centre flow pressure 1 positive	R	0	0	1	---
58	DataCentre_Flow_Press_2_ Positive	Data Centre flow pressure 2 positive	R	0	0	1	---
59	VenturiInletPress_Positive	Venturi inlet pressure positive	R	0	0	1	---
61	Din_KA1	Digital input KA1	R	0	0	1	---
62	Din_KA2	Digital input KA2	R	0	0	1	---
63	Din_KA3	Digital input KA3	R	0	0	1	---
64	Din_KA4	Digital input KA4	R	0	0	1	---
65	Din_BEMS_Interlock	Din BEMS Interlock	R	0	0	1	---
67	Din_LeakLevel	Leak Level	R	0	0	1	---
68	Din_Flow_Switch	Din Venturi flow sensor	R	0	0	1	---
69	Din_InverterBusOk_Pump1	Din Inverter Bus Ok Pump1	R	0	0	1	---
70	Din_InverterFault_Pump1	Din Inverter Fult Pump1	R	0	0	1	---
73	Din_Config_In1	Din Configurable Digital input 1 status	R	0	0	1	---
74	Din_Config_In2	Din Configurable Digital input 2 status	R	0	0	1	---
75	Din_Config_In3	Din Configurable Digital input 3 status	R	0	0	1	---

BMS Address	Variable name	Description	Read/ Write	Default	Min	Max	Unit
95	AI_Low_VenturiInletPress	Alarm Venturi Inlet Press Low	R	0	0	1	---
96	AI_Flow_Switch	Flow Switch Alarm	R	0	0	1	---
97	AI_Fault_Group_Pumps	All available pumps (group) failed	R	0	0	1	---
100	RESET_ALARMS	Request to reset/clear alarm memories	R/W	0	0	1	---
111	AI_High_Priority	High priority alarm active	R	0	0	1	---
112	AI_Low_Priority	Low priority alarm active	R	0	0	1	---
115	AI_LeakLevel	Leak Level Alarm	R	0	0	1	---

B

LPS unit main components

The appearance and main components of an LPS unit depend on the model. The following diagrams illustrate the main components for the standard LPS units.

LPS 500

Item	Description
1	Cooling inlet 6”
2	Cooling outlet 6”
3	Recirculation hot inlet 6”
4	Recirculation cold outlet 6”
5	Motive hot inlet 8”
6	Motive hot outlet 10”

Item	Description
7	Main unit control panel
8	Motive pump isolator
9	Motive pump inverter
10	Recirculating pump inverter
11	Recirculating pump isolator
12	Lifting support angle

LPS 150

Item	Description
1	Unit fill
2	Air outlet
3	Cooling inlet
4	Cooling outlet
5	Data center outlet
6	Data center inlet

LPS 100

Item	Description
1	Unit fill
2	Air outlet
3	Cooling outlet
4	Cooling inlet
5	Data center inlet
6	Data center outlet

C

General arrangement

The following diagram shows the general arrangement of the pressurisation pump.

E			
D			
C			
B			
A	.	.	.
*	Name	Date	Modification

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Aqua Cooling Solutions Ltd
incorporating Stadco Cooling
Unit D4, Segensworth Business Center
Segensworth Road
Fareham. PO15 5RQ

t ++44 (0)23 8064 1800
f ++44 (0)23 8064 1801
e sales@aquacooling.co.uk
w www.aquacooling.co.uk

Aqua Cooling Solutions

Drawn:	G.T.	Client:	
Date:	03.07.15	Title:	PRESSURISATION 1 PUMP BASIC + HL VOLT FREE CONTACTS PSM 70 5.5BAR GENERAL ARRANGEMENT
Final:			
Quote:		Drawing Ref:	GT031715

D

Electrical schematics

The following pages provide the specifications and technical information for the electrical systems.

ESSE002E

AQUA COOLING SOLUTIONS LIMITED

UNIT D4 SEGENSWORTH BUSINESS CENTRE
SEGENSWORTH ROAD, FAREHAM
HAMPSHIRE, PO15 5RQ
Tel.: +44 (0) 845 0941 800 Fax.: +44 (0) 845 0941 900

Customer :
Plant Designation : CP1
Drawing number : P15033
Project Number :

End User :

Site Location :

Control panel by : Shellau
Incoming supply : 110VAC
Feeder :
Control voltage : 24VDC
Manufacturing date : July 2015
Degree of protect. : IP65
Panel Location :

ISSUED FOR MANUFACTURE = 22/07/2015

Created on : 08. Jun. 2015
Responsible for project : Mike West
Date changed : 22. Jul. 2015
Editor : MDC

Highest Page No. : 135
No. of pages : 63

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2	Table of Contents		22. Jul. 2015	MDC	x
3	Table of Contents		22. Jul. 2015	MDC	x
4	Table of Contents		22. Jul. 2015	MDC	x
5	General Specifications & Technical Information		22. Jul. 2015	M. CARMODY	
10	PLC Overview		21. Jul. 2015	MDC	
20	110VAC Power Supply Main Distribution		22. Jul. 2015	M. CARMODY	
30	110VAC & 24VDC Distribution		22. Jul. 2015	M. CARMODY	
40	Pump VSD's		22. Jul. 2015	MDC	
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43	Control Field Devices		22. Jul. 2015	MDC	
50	Carel pCO5+ Controller		22. Jul. 2015	MDC	
51	Carel pCO5+ Controller Universal Analogue Inputs		21. Jul. 2015	M. CARMODY	
52	Carel pCO5+ Controller Universal Analogue Inputs		21. Jul. 2015	MDC	
53	Carel pCO5+ Controller Digital Inputs		22. Jul. 2015	M. CARMODY	
54	Carel pCO5+ Controller Digital Inputs		22. Jul. 2015	MDC	
55	Carel pCO5+ Controller Digital Inputs		22. Jul. 2015	MDC	
60	Carel pCO5+ Controller Analogue Outputs		21. Jul. 2015	M. CARMODY	
61	Carel pCO5+ Controller Digital Relay Outputs		21. Jul. 2015	M. CARMODY	
62	Carel pCO5+ Controller Digital Relay Outputs		21. Jul. 2015	MDC	
63	Carel pCO5+ Controller Digital Relay Outputs		21. Jul. 2015	MDC	
70	CP1 Panel Arrangement		22. Jul. 2015	MDC	
71	CP1 Label Engraving Details		22. Jul. 2015	MDC	
72	CP1 Backplate Arrangement		22. Jul. 2015	MDC	
80	CP2 Panel Arrangement Backplate Arrangement		11. Jun. 2015	MDC	
90	Bill of Materials		21. Jul. 2015	TMC	
91	Bill of Materials		21. Jul. 2015	TMC	
92	Bill of Materials		21. Jul. 2015	TMC	
93	Bill of Materials		21. Jul. 2015	TMC	

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95	Bill of Materials		21. Jul. 2015	TMC	
102	X1CP2		15. Jun. 2015	MDC	x
106	-X4		15. Jun. 2015	MDC	x
107	-X5		15. Jun. 2015	MDC	x
108	Terminal strip and connector overview		15. Jun. 2015	MDC	x
109	Cable overview		15. Jun. 2015	MDC	x
110	W40DI1 PUMP - RTP1 LPS ISOLATOR TO VSD		15. Jun. 2015	MDC	x
111	W40DI2 PUMP - CTP1 RECIRCULATION		15. Jun. 2015	MDC	x
112	W40M1 PUMP - RTP1 LPS		15. Jun. 2015	MDC	x
113	W40M2 PUMP - CTP1 RECIRCULATION		15. Jun. 2015	MDC	x
114	W40TT5 CTP1 TEMPERATURE SENSOR		15. Jun. 2015	MDC	x
115	W40VSD-M1 MODBUS NETWORK		15. Jun. 2015	MDC	x
116	W40VSD-M2 MODBUS NETWORK		15. Jun. 2015	MDC	x
117	W40VSD1 VENTURI FLOW PRESSURE		15. Jun. 2015	MDC	x
118	W40VSD2 CTP1 TEMPERATURE SENSOR		15. Jun. 2015	MDC	x
119	W42FS1 VENTURI THERMAL FLOW SWITCH		15. Jun. 2015	MDC	x
120	W42LS1 LEAK LEVEL SENSOR		15. Jun. 2015	MDC	x
121	W42PT1 NEGATIVE VENTURI SUCTION No. 1		15. Jun. 2015	MDC	x
122	W42PT2 NEGATIVE VENTURI SUCTION No. 2		15. Jun. 2015	MDC	x
123	W43SV1 AIR RELEASE SOLENOID VALVE		15. Jun. 2015	MDC	x
124	W51PT3 VENTURI INLET PRESSURE		15. Jun. 2015	MDC	x
125	W51PT4 DATA CENTRE FLOW PRESSURE No. 1		15. Jun. 2015	MDC	x
126	W51PT5 DATA CENTRE FLOW PRESSURE No. 2		15. Jun. 2015	MDC	x
127	W51TT1 CHILLER FLOW TEMPERATURE		15. Jun. 2015	MDC	x
128	W51TT2 CHILLER RETURN TEMPERATURE		15. Jun. 2015	MDC	x
129	W52TT3 DATA CENTRE RETURN TEMPERATURE		15. Jun. 2015	MDC	x
130	W52TT4 DATA CENTRE FLOW TEMPERATURE		15. Jun. 2015	MDC	x
131	WX1-40VSD1 40VSD1 CONTROL		15. Jun. 2015	MDC	x
132	WX2-40VSD2 40VSD2 CONTROL		15. Jun. 2015	MDC	x

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133	WX5.1 DATA CENTRE FLOW PRESSURE No.1		15. Jun. 2015	MDC	x
134	WX5.2 DATA CENTRE FLOW PRESSURE No.2		15. Jun. 2015	MDC	x
135	WX5.3 DATA CENTRE FLOW TEMPERATURE		15. Jun. 2015	MDC	x

			Date		CP1		AQUA COOLING SOLUTIONS	Table of Contents	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 4
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

GENERAL SPECIFICATIONS AND TECHNICAL INFORMATION

CONTROL PANEL DETAILS	SPECIFICATION	NOTE COMMENTS: -	PAINT FINISH	SPECIFICATION
TOTAL SIZE OF ENCLOSURE/CONTROL PANEL/S	800(H)x600(W)x250(D)mm		GLOSS: SEMI GLOSS: MATT: POWDER-COATED etc	RITTAL STANDARD PAINT FINISH
APPROXIMATE OVERALL WEIGHT			EXTERIOR COLOUR (EXCLUDING DOORS)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SYSTEM SUPPLY	1 PHASE/NEUTRAL/EARTH 110VAC/60Hz		EXTERIOR COLOUR (DOORS)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SYSTEM SUPPLY TYPE			INTERIOR COLOUR (EXCLUDING BACKPLATE)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SYSTEM SUPPLY REQUIREMENTS	13AMP SUPPLY		INTERIOR COLOUR (INSIDE OF DOORS)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SYSTEM SUPPLY ALLOWANCES FOR DIVERSITY	DIVERSITY 100%FLC CONNECTED		MOUNTING PLATE/S	RITTAL STANDARD (ZINC PLATED)
SYSTEM SUPPLY DESIGN CURRENT REQUIREMENTS			BASE/PLINTH (FITTED)	RITTAL STANDARD (RAL 7022)
MAIN SUPPLY ISOLATOR TYPE 400AMP FUSE DISCONNECTOR	25AMP / 25kA MAIN ISOLATOR		CABLE CHAMBER (NOT FITTED)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SHORT CIRCUIT CAPACITY	10KA			
APPARENT POWER (KVA CONNECTED)		P = V x I x 1.732		
ACTIVE POWER (KW CONNECTED)		P = V x I x 1.732 x 0.8		
DC CONTROL POWER (WATTS CONNECTED)		POWER SUPPLY UNIT 400VAC/24VDC/60AMP/1440W.		
ENCLOSURE LIGHTS & SOCKETS, VOLTAGE	230VAC			
CONTROL & INDICATION VOLTAGE	24VDC			

PROTECTION	SPECIFICATION	COMMENTS: -	PLC EQUIPMENT	SPECIFICATION
BS/EN/IEC STANDARDS IMPLEMENTED	EN292/BSEN954-1/BSEN60204-1/BS7671	NOTE: -ALL APPLICABLE & RELEVANT STANDARDS etc.	PLC MAKE	CAREL
DEGREE OF ENCLOSURE PROTECTION (IP RATING)	IP54		PLC TYPE	PC05
DETAILS OF EQUIPMENT BY BARRIER SCREENING	25VAC/60VDC AND ABOVE (IP20B)	NOTE: -DRY ENVIRONMENTS MAINTAINED (EN60204)	PLC INTERFACE	
EQUIPOTENTIAL BONDING IMPLEMENTED	YES	BS7671 STANDARDS		
AUTOMATIC DISCONNECTION INSTALLED	YES			
MANUFACTURERS SPECIFICATIONS IMPLEMENTED	YES			
EMC STANDARDS REQUIRED (SCREENING)	YES	MANUFACTURERS EMC REQUIREMENTS IMPLEMENTED		
STANDARD LABELS TO BE FITTED	YES	HAZARDS/WARNING SIGNS AND VOLTAGE LABELS		

CONDUCTORS AND TERMINATIONS	SPECIFICATION	COMMENTS: -	CABLE COLOURS	SPECIFICATION
MINIMUM SIZE OF POWER WIRING	1.5mm²		AC 460VAC POWER WIRING	BLACK
MINIMUM SIZE OF CONTROLS & I/O WIRING 24VDC	1.0mm² (I/O 0.5mm²)		AC 230VAC POWER WIRING	BLACK
MINIMUM SIZE OF POWER TERMINALS	4.0mm TERMINATION		PROTECTIVE CONDUCTOR	GREEN/YELLOW
MINIMUM SIZE OF CONTROL TERMINALS	2.5mm TERMINATION		AC 110VAC POWER WIRING - 110V	RED
MAIN POWER BUSBAR SIZE			AC 110VAC POWER WIRING - 0V	WHITE/RED
MAIN EARTH BUSBAR SIZE			DC CONTROL CIRCUITS +	DARK BLUE
EARTH BUSBAR POSITIONS			DC CONTROL CIRCUITS -	WHITE/BLUE
METHOD OF TERMINATING OUTGOING PROTECTIVE CONDUCTORS	BUSBAR AND/OR PE TERMINALS		NEUTRAL CIRCUITS	LIGHT BLUE
EXTERNAL CABLES, ENTRY POSITION	BOTTOM/TOP ENTRY		LIVE SIDE OF ISOLATOR CIRCUITS	ORANGE
METHOD OF FIXING/SUPPORTING OUTGOING CABLES	CABLE TRUNKING/TRAY		EXTERNALLY FED INTERLOCKS CIRCUITS (AC)	ORANGE
SCHEMATIC SYMBOLS & CONTACT REFERENCE NUMBERS Etc	SYMBOLS BS EN 60617	EQUIPMENT PAGE-PATH NUMBERING.	EXTERNALLY FED INTERLOCKS CIRCUITS (DC)	ORANGE

GENERAL COMMENTS: -

50E4
50/1
UNIVERSAL ANALOGUE INPUTS

ADDRESS	PAGE	FUNCTION
U1	51/0	NEGATIVE PRESSURE VENTURI SUCTION
U2	51/1	NEGATIVE PRESSURE VENTURI SUCTION
U3	51/2	VENTURI INLET PRESSURE
U4	51/4	CHILLER FLOW TEMPERATURE
U5	51/5	CHILLER RETURN TEMPERATURE
U6	51/7	DATA CENTRE FLOW PRESSURE No. 1
U7	51/8	DATA CENTRE FLOW PRESSURE No. 2
U8	51/8	TANK LEVEL (NOT SELECTED)
U9	52/3	DATA CENTRE RETURN TEMPERATURE
U10	52/5	DATA CENTRE FLOW TEMPERATURE

50E4
50/1
ANALOGUE OUTPUTS

ADDRESS	PAGE	FUNCTION
Y1	60/2	HEAT EXCHANGER PRIMARY CONTROL VALE CHILLER (NOT SELECTED)
Y2	60/3	NEGATIVE PRESURE CONTROL VALVE LPS (NOT SELECTED)
Y3	60/4	SPARE
Y4	60/5	SPARE
Y5	60/6	SPARE
Y6	60/7	SPARE

50E4
50/1
24VDC DIGITAL INPUTS

ADDRESS	PAGE	FUNCTION
ID1	53/0	RTP1 LPS PUMP INVERTER FAULT
ID2	53/1	SPARE
ID3	53/2	SPARE
ID4	53/3	SPARE
ID5	53/4	CTP1 RECIRCULATION PUMP INVERTER FAULT
ID6	53/5	SPARE
ID7	53/6	SPARE
ID8	53/7	SPARE
ID9	54/0	LEAK DETECTION (NOT SELECTED)
ID10	54/1	B. E. M. S. INTERLOCK
ID11	54/2	24VDC CONTROL CIRCUIT HEALTHY
ID12	54/3	VENTURI FLOW SENSOR
ID13H	54/4	SPARE
ID13	54/5	SPARE
ID14	54/6	LEAK LEVEL SENSOR
ID14H	54/7	SPARE
ID15H	55/1	SPARE
ID15	55/2	SELECTION SETPOINT HEAT EXCHANGER
ID16	55/3	CONFIGURABLE INPUT No. 1 (NOT SELECTED)
ID16H	55/4	SPARE
ID17	55/5	CONFIGURABLE INPUT No. 2 (NOT SELECTED)
ID18	55/6	CONFIGURABLE INPUT No. 3 (NOT SELECTED)

50E4
50/1
DIGITAL RELAY OUTPUTS

ADDRESS	PAGE	FUNCTION
NO1	61/0	RTP1 + CTP1 PUMP ENABLE
NO2	61/1	AIR RELEASE SOLENOID VALVE
NO3	61/2	SPARE
NO4	61/3	SPARE
NO5	61/4	HIGH PRIORITY ALARM
NO6	61/5	SPARE
NO7	61/7	SPARE
NO8	61/8	SPARE
NC8	61/9	SPARE
NO9	62/0	SPARE
NO10	62/1	SPARE
NO11	62/2	SPARE
NO12	62/4	SPARE
NC12	62/4	SPARE
NO13	62/6	CONFIGURABLE OUTPUT No. 1 (NOT SELECTED)
NC13	62/6	SPARE
NO14	62/8	LPS PUMP No. 1 ENABLE (NOT SELECTED)
NC14	62/8	SPARE
NO15	63/2	LPS PUMP No. 2 ENABLE (NOT SELECTED)
NC15	63/3	SPARE
NO16	63/4	SPARE
NO17	63/5	SPARE
NO18	63/6	SPARE

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			Date	08. Jun. 2015	CP1		AQUA COOLING SOLUTIONS	110VAC Power Supply Main Distribution	P15033	=
			Editor	M. CARMODY						+
			Tested	22. Jul. 2015						P. 20
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

			Date	08. Jun. 2015	CP1		AQUA COOLING SOLUTIONS	110VAC & 24VDC Distribution	P15033	=
			Editor	M. CARMODY						+
			Tested	22. Jul. 2015						P. 30
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	Pump VSD's	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 40
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	Pump Control	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 41
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	Control Field Devices	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 42
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	Control Field Devices	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 43
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 50
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

50 52

			Date		CP1	AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Universal Analogue Inputs
			Editor	M. CARMODY			
			Tested	22. Jul. 2015			
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.

P15033

=
+

P. 51
135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Universal Analogue Inputs	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 52
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

52 54

			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Digital Inputs	P15033
			Editor	M. CARMODY					
			Tested	22. Jul. 2015					
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.		

=
+

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135 P.

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			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Digital Inputs	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 54
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Digital Inputs	P15033
			Editor	MDC					
			Tested	22. Jul. 2015					
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.		

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+

50E4
50/1

ANALOGUE OUTPUTS

CAREL pCO5+

10/5 Y1	10/5 Y2	10/5 Y3	10/5 Y4	10/5 Y5	10/5 Y6	VG / VG0
J4-Y1	J4-Y2	J4-Y3	J4-Y4	J20-Y5	J20-Y6	J4 VG / J4 VG0
HEAT EXCHANGER PRIMARY CONTROL VALE CHILLER (NOT SELECTED)	NEGATIVE PRESURE CONTROL VALVE LPS (NOT SELECTED)	SPARE	SPARE	SPARE	SPARE	

			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Analogue Outputs	P15033
			Editor	M. CARMODY					
			Tested	22. Jul. 2015					
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.		

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62

			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Digital Relay Outputs	P15033	=	
			Editor	M. CARMODY						+	
			Tested	22. Jul. 2015							P. 61
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.				135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Digital Relay Outputs	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 62
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

50E4
50/1

RELAY DIGITAL OUTPUTS

CAREL pCO5+

LPS PUMP
No. 2
ENABLE

(NOT SELECTED)

SPARE

SPARE

SPARE

SPARE

			Date		CP1		AQUA COOLING SOLUTIONS	Carel pCO5+ Controller Digital Relay Outputs	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 63
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

0	1	2	3	4	5	6	7	8	9

70ENC1

1.

2.

MANUFACTURING NOTE: -
ALL DIMENSIONS AND POSITIONS
ARE APPROXIMATE SCALE 1:2
(A3 PRINT SIZE)

			Date		CP1		AQUA COOLING SOLUTIONS	CP1 Panel Arrangement
			Editor	MDC				
			Tested	22. Jul. 2015				
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.	

P15033

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P. 70
135 P.

71LAB1

1. DANGER 110VAC

71LAB2

12. ISOLATE HERE
BEFORE OPENING DOOR

71LAB3

SUPPLY VOLTAGE	110V
CONTROL VOLTAGE	24VDC
INCOMING CABLE SIZE	
IP RATING	IP65
MANUFACTURING DATE	JULY 2015
SCL GROUP PROJECT NUMBER	P15033
SCL GROUP DRAWING NUMBER	P15033/CP1
CLIENT	AQUA COOLING SOLUTIONS
CLIENT PROJECT NUMBER	CNxxxx

71LAB4

NOTICE - AFTER COMMISSIONING
THIS CONTROL PANEL SHOULD BE ISOLATED
AND ALL TERMINATIONS TIGHTENED

			Date		CP1		AQUA COOLING SOLUTIONS	CP1 Label Engraving Details	P15033	=	
			Editor	MDC						+	
			Tested	22. Jul. 2015							P. 71
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.				135 P.

			Date		CP1		AQUA COOLING SOLUTIONS	CP1 Backplate Arrangement	P15033
			Editor	MDC					
			Tested	22. Jul. 2015					
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.		

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P. 72
135 P.

MANUFACTURING NOTE: -
ALL DIMENSIONS AND POSITIONS
ARE APPROXIMATE SCALE 1:2
(A3 PRINT SIZE)

			Date		CP1		AQUA COOLING SOLUTIONS	CP2 Panel Arrangement Backplate Arrangement	P15033	=
			Editor	MDC						+
			Tested	22. Jul. 2015						P. 80
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			135 P.

DEVICE DESIGNATION	DESCRIPTION	MODEL TYPE/PART №	MANUFACTURER	UNIT QUANTITY	SCHEMATIC PAGE. PATH	LINE CODE	ITEM №
20Q1	UL98 3 POLE 30A DISCONNECT SWITCH	AB194R-N30-1753	ALLEN BRADLEY	1	20. 1		1
20Q1	12" EXTENSION SHAFT	AB194R-RS1	ALLEN BRADLEY	1	20. 1		2
20Q1	AB194R BLACK PISTOL HANDLE	AB194R-PB	ALLEN BRADLEY	1	20. 1		3
20Q1	AB194R 3 POLE COVER	AB194R-30C3	ALLEN BRADLEY	2	20. 1		4
20EB1	M8x40mm BRASS HEX BOLT	M8X40	Merlin	1	20. 2		5
20EB1	M8 CUT WASHER	M8S	Merlin	1	20. 2		6
20EB1	M8 BRASS WASHER	M8W	Merlin	5	20. 2		7
20EB1	M8 BRASS NUT	M8N	Merlin	3	20. 2		8
20EB2	4mm PE Terminal	57.504.9055.0	WIELAND ELECTRIC	4	20. 2		9
30F1	4A 1 POLE AC C CURVE MCB	AB1489-M1C040	ALLEN BRADLEY	1	30. 1		10
30F1	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	1	30. 1		11
30H1	120V 60Hz STANDARD LIGHT WITH DOOR OPERATED SWITCH	SZ 4138.250	Rittal Ltd	1	30. 1		12
30H1	Universal Bracket - AE/TP	SZ 2373.000	Rittal Ltd	2	30. 1		13
30H1	SZ CONNECTION CABLE - 3M	SZ 4315.150	Rittal Ltd	1	30. 1		14
30F2	6A 1 POLE AC C CURVE MCB	AB1489-M1C060	ALLEN BRADLEY	1	30. 5		15
30F2	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	1	30. 5		16
30F2	2.5/4mm END PLATE	07.311.0155.0	WIELAND ELECTRIC	1	30. 5		17
30PS1	85...264VAC 24VDC POWER SUPPLY 5A	AB1606XLE120E	ALLEN BRADLEY	1	30. 5		18
30F3	6A 1 POLE DC C CURVE MCB	AB1492-D1C060	ALLEN BRADLEY	1	30. 5		19
30H2	CLEAR PILOT LAMP	800FP-P7	ALLEN BRADLEY	1	30. 6		20

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			Editor	TMC			
			Tested	22. Jul. 2015			
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.

P15033

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DEVICE DESIGNATION	DESCRIPTION	MODEL TYPE/PART №	MANUFACTURER	UNIT QUANTITY	SCHEMATIC PAGE. PATH	LINE CODE	ITEM №
30H2	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	30. 6		21
30H2	110V WHITE LED MODULE	800F-N5W	ALLEN BRADLEY	1	30. 6		22
30H3	CLEAR PILOT LAMP	800FP-P7	ALLEN BRADLEY	1	30. 6		23
30H3	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	30. 6		24
30H3	24VAC/DC WHITE LED MODULE	800F-N3W	ALLEN BRADLEY	1	30. 6		25
40VSD1	15.0KW IP55 INVERTER DRIVE H5 FILTER	FC102P15KT4E55H5	DANFOSS	1	40. 0		26
40DI1	UL ENCLOSED STEEL FUSED DISCONNECT SWITCH	AB194R-FJ60-1753-PB	ALLEN BRADLEY	1	40. 0		27
40DI1	40A CLASS J SERIES FUSE	JKS-40	BUSSMAN	3	40. 0		28
X1	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	7	40. 2		29
X1	TERMINAL END STOP	Z5.522.8555.0	WIELAND ELECTRIC	2	40. 2		30
X1	4mm Knife Terminal	57.504.2055.0	WIELAND ELECTRIC	3	40. 2		31
40VSD2	4.0KW IP55 INVERTER DRIVE H5 FILTER	FC102P4K0T4E55H5	DANFOSS	1	40. 5		32
40DI2	UL ENCLOSED STEEL FUSED DISCONNECT SWITCH	AB194R-FJ30-1753-PB	ALLEN BRADLEY	1	40. 5		33
40DI2	20A CLASS J SERIES FUSE	JKS-20	BUSSMAN	3	40. 5		34
X2	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	7	40. 6		35
X2	TERMINAL END STOP	Z5.522.8555.0	WIELAND ELECTRIC	2	40. 6		36
X2	4mm Knife Terminal	57.504.2055.0	WIELAND ELECTRIC	3	40. 6		37
CP2	200x200x80mm KL TERMINAL BOX RAL 7035	KL 1515.510	Rittal Ltd	1	40. 6		38
CP2	200x200x80mm KL MOUNTING PLATE RAL 7035	KL 1562.700	Rittal Ltd	1	40. 6		39
X1CP2	2.5mm Terminal	57.503.0055.0	WIELAND ELECTRIC	12	40. 7		40

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Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.

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DEVICE DESIGNATION	DESCRIPTION	MODEL TYPE/PART №	MANUFACTURER	UNIT QUANTITY	SCHEMATIC PAGE. PATH	LINE CODE	ITEM №
X1CP2	2.5/4mm END PLATE	07.311.0155.0	WIELAND ELECTRIC	1	40. 7		41
X1CP2	TERMINAL END STOP	Z5.522.8555.0	WIELAND ELECTRIC	2	40. 7		42
41S1	3 POSITION SELECTOR SWITCH	800FP-SM32	ALLEN BRADLEY	1	41. 1		43
41S1	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	41. 1		44
41S1	N.O. CONTACT BLOCK	800F-X10	ALLEN BRADLEY	2	41. 1		45
41H4	GREEN PILOT LAMP	800FP-P3	ALLEN BRADLEY	1	41. 2		46
41H4	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	41. 2		47
41H4	24VAC/DC GREEN LED MODULE	800F-N3G	ALLEN BRADLEY	1	41. 2		48
41K1	24VDC 2 POLE CHANGEOVER RELAY	AB700HLT12Z24	ALLEN BRADLEY	1	41. 3		49
41H5	RED PILOT LAMP	800FP-P4	ALLEN BRADLEY	1	41. 3		50
41H5	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	41. 3		51
41H5	24VAC/DC RED LED MODULE	800F-N3R	ALLEN BRADLEY	1	41. 3		52
41S2	3 POSITION SELECTOR SWITCH	800FP-SM32	ALLEN BRADLEY	1	41. 5		53
41S2	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	41. 5		54
41S2	N.O. CONTACT BLOCK	800F-X10	ALLEN BRADLEY	2	41. 5		55
41H6	GREEN PILOT LAMP	800FP-P3	ALLEN BRADLEY	1	41. 6		56
41H6	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	41. 6		57
41H6	24VAC/DC GREEN LED MODULE	800F-N3G	ALLEN BRADLEY	1	41. 6		58
41K2	24VDC 2 POLE CHANGEOVER RELAY	AB700HLT12Z24	ALLEN BRADLEY	1	41. 7		59
41H7	RED PILOT LAMP	800FP-P4	ALLEN BRADLEY	1	41. 7		60

DEVICE DESIGNATION	DESCRIPTION	MODEL TYPE/PART №	MANUFACTURER	UNIT QUANTITY	SCHEMATIC PAGE. PATH	LINE CODE	ITEM №
41H7	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	41. 7		61
41H7	24VAC/DC RED LED MODULE	800F-N3R	ALLEN BRADLEY	1	41. 7		62
X3	4mm Knife Terminal	57.504.2055.0	WIELAND ELECTRIC	5	42. 1		63
X3	TERMINAL END STOP	Z5.522.8555.0	WIELAND ELECTRIC	2	42. 1		64
X3	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	5	42. 1		65
X3	2.5/4mm END PLATE	07.311.0155.0	WIELAND ELECTRIC	1	42. 1		66
42K3	24VDC 2 POLE CHANGEOVER RELAY	AB700HLT12Z24	ALLEN BRADLEY	1	42. 2		67
42K4	24VDC 2 POLE CHANGEOVER RELAY	AB700HLT12Z24	ALLEN BRADLEY	1	42. 4		68
42E1	WAS5 CCC 20LP SIGNAL MULTIPLIER	KL8581160000	Weidmüller	1	42. 7		69
X4	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	9	43. 1		70
X4	TERMINAL END STOP	Z5.522.8555.0	WIELAND ELECTRIC	2	43. 1		71
X4	4mm Knife Terminal	57.504.2055.0	WIELAND ELECTRIC	1	43. 1		72
43H8	YELLOW PILOT LAMP	800FP-P5	ALLEN BRADLEY	1	43. 1		73
43H8	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	43. 1		74
43H8	24VAC/DC WHITE LED MODULE	800F-N3W	ALLEN BRADLEY	1	43. 1		75
43H9	RED PILOT LAMP	800FP-P4	ALLEN BRADLEY	1	43. 2		76
43H9	PLASTIC MOUNTING LATCH	800F-ALP	ALLEN BRADLEY	1	43. 2		77
43H9	24VAC/DC RED LED MODULE	800F-N3R	ALLEN BRADLEY	1	43. 2		78
X6	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	10	43. 6		79
X6	TERMINAL END STOP	Z5.522.8555.0	WIELAND ELECTRIC	2	43. 6		80

DEVICE DESIGNATION	DESCRIPTION	MODEL TYPE/PART №	MANUFACTURER	UNIT QUANTITY	SCHEMATIC PAGE. PATH	LINE CODE	ITEM №
X6	2.5/4mm END PLATE	07.311.0155.0	WIELAND ELECTRIC	1	43. 6		81
50E3	PGD1 GRAPHICS TERMINAL	PGD1000FW0	Carel	1	50. 1		82
50E4	pCO5+ CAREL CONTROLLER LARGE FB/BMS, NO OPTO, NO USB	P+500B0A000L0	Carel	1	50. 1		83
X5	3 Tier Terminal	57.503.8855.0	WIELAND ELECTRIC	7	51. 2		84
X5	TERMINAL END STOP	Z5.522.8555.0	WIELAND ELECTRIC	2	51. 2		85
X5	70 WAY BLUE COMB	Z7.267.0027.6	WIELAND ELECTRIC	1	51. 2		86
-X4	4mm Knife Terminal	57.504.2055.0	WIELAND ELECTRIC	1	54. 1		87
-X4	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	1	54. 1		88
-X4	2.5/4mm END PLATE	07.311.0155.0	WIELAND ELECTRIC	1	54. 1		89
-X5	3 Tier Terminal	57.503.8855.0	WIELAND ELECTRIC	4	55. 2		90
61K5	24VDC 2 POLE CHANGEOVER RELAY	AB700HLT12Z24	ALLEN BRADLEY	1	61. 0		91
61K6	24VDC 2 POLE CHANGEOVER RELAY	AB700HLT12Z24	ALLEN BRADLEY	1	61. 1		92
61K7	24VDC 2 POLE CHANGEOVER RELAY	AB700HLT12Z24	ALLEN BRADLEY	1	61. 8		93
62K8	24VDC 2 POLE CHANGEOVER RELAY	AB700HLT12Z24	ALLEN BRADLEY	1	62. 4		94
70ENC1	800x600x250mm AE ENCLOSURE	AE 1058.500	Rittal Ltd	1	70. 2		95
-71LAB1	105x20mm ENGRAVED LABEL - Y/B/Y	LAB8	CE Controls	1	71. 5		96
-71LAB2	105x20mm ENGRAVED LABEL - Y/B/Y	LAB8	CE Controls	1	71. 5		97
-71LAB3	RATING PLATE	LAB10	CE Controls	1	71. 5		98
-71LAB4	COMMISSIONING NOTICE	LAB11	CE Controls	1	71. 5		99
-72TR1	40X80mm NARROW TRUNKING	E154	Lovato Electric	1	72. 2		100

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			Editor	TMC			
			Tested	22. Jul. 2015			
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.

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DEVICE DESIGNATION	DESCRIPTION	MODEL TYPE/PART №	MANUFACTURER	UNIT QUANTITY	SCHEMATIC PAGE. PATH	LINE CODE	ITEM №
-72TR2	40X80mm NARROW TRUNKING	E154	Lovato Electric	1	72. 2		101
-72TR6	60x80mm NARROW TRUNKING	E114	Lovato Electric	1	72. 2		102
-72TR4	40X80mm NARROW TRUNKING	E154	Lovato Electric	1	72. 3		103
-72TR5	40X80mm NARROW TRUNKING	E154	Lovato Electric	1	72. 3		104
-72DR2	35mm X 15mm TOP HAT SLOTTED RAIL HEAVY DUTY	TS35HS	Lovato Electric	1	72. 6		105
-72DR3	35mm X 15mm TOP HAT SLOTTED RAIL HEAVY DUTY	TS35HS	Lovato Electric	1	72. 6		106
-72DR1	35mm X 15mm TOP HAT SLOTTED RAIL HEAVY DUTY	TS35HS	Lovato Electric	1	72. 6		107
-72TR3	40X80mm NARROW TRUNKING	E154	Lovato Electric	1	72. 7		108
-72DR4	35mm X 15mm TOP HAT SLOTTED RAIL HEAVY DUTY	TS35HS	Lovato Electric	1	72. 7		109

Terminal diagram

ESSK034E

Function text					W52TT4	W51PT5	W51PT4	W40TT5	Cable name	Strip designation X1CP2							Cable name	W40VSD2	WX5.1	WX5.2	WX5.3	Page/ path
					8761	8761	8761	8761	Type	Target design.	Connection	Terminal number	Jumpers	Connection	Target design.	Connection	Type	8761	8761	8761	8761	
PUMP - CTP1							White			-40TT5	SIG	1	○		-40VSD2	54	White					40/7
PUMP - CTP1							Black			-40TT5	+V	2	○		-40VSD2	13	Black					40/7
PUMP - CTP1								SH		W40TT5	SHIELD	3	○		-40VSD2	SHL		SH				40/7
DATA CENTRE FLOW PRESSURE No. 1						White				-51PT4	2	4	○	U6	-X5	4		White				51/7
DATA CENTRE FLOW PRESSURE No. 1						Black				-51PT4	1	5	○		-X5	COM		Black				51/7
DATA CENTRE FLOW PRESSURE No. 1							SH			W51PT4	SHIELD	6	○		-X5	SCN			SH			51/7
DATA CENTRE FLOW PRESSURE No. 2					White					-51PT5	2	7	○	U7	-X5	5			White			51/8
DATA CENTRE FLOW PRESSURE No. 2					Black					-51PT5	1	8	○		-X5	COM			Black			51/8
DATA CENTRE FLOW PRESSURE No. 2						SH				W51PT5	SHIELD	9	○		-X5	SCN				SH		51/8
DATA CENTRE FLOW TEMPERATURE				White						-52TT4	~	10	○	U10	-X5	7				White		52/5
DATA CENTRE FLOW TEMPERATURE				Black						-52TT4	~	11	○		-X5	COM				Black		52/5
DATA CENTRE FLOW TEMPERATURE					SH					W52TT4	SHIELD	12	○		-X5	SCN					SH	52/5

			Date	15. Jun. 2015	CP1	AQUA COOLING SOLUTIONS	X1CP2	P15033
			Editor	MDC				
			Tested	22. Jul. 2015				
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.	

Terminal diagram

ESSK034E

Function text	YYNR	Cable name / Type	Strip designation -X4: Target design.	Connection	Terminal number	Jumpers	Connection	Target design.	Connection	Cable name / Type					Page/ path
	W43SV1	Cable name								Cable name					
LOW PRIORITY ALARM (OPEN ON ALARM)					1	○		-61K10	31		X				43/1
LOW PRIORITY ALARM (OPEN ON ALARM)					2	○		-61K10	34		X				43/1
HIGH PRIORITY ALARM (OPEN ON ALARM)					3	○		-61K11	31		X				43/2
HIGH PRIORITY ALARM (OPEN ON ALARM)					4	○		-61K11	34		X				43/2
AIR RELEASE SOLENOID VALVE	1		-43SV1	1	5	○		-61K9	24			X			43/4
AIR RELEASE SOLENOID VALVE	2		-43SV1	2	6	○		-43H9	x1				X		43/4
AIR RELEASE SOLENOID VALVE	PE		-43SV1	PE	7	○									43/4
B.E.M.S. INTERLOCK (LINK IF NOT REQUIRED)					8	○		-61K9	21			X			43/6
B.E.M.S. INTERLOCK (LINK IF NOT REQUIRED)					9	○		-43K8	a1			X			43/6

Terminal diagram

ESSK034E

Function text		WX5.3 8761	W52TT3 8761	WX5.2 8761	WX5.1 8761	W51TT2 8761	W51TT1 8761	W51PT3 8761	Cable name Type	Strip designation -X5 Target design.	Connection	Terminal number	Jumpers	Connection	Target design.	Connection	Cable name Type					Page/ path
VENTURI INLET PRESSURE							White			-51PT3	2	1	○	U3	-50E4	J2-U3		X				51/2
CHILLER FLOW TEMPERATURE						White				-51TT1	~	2	○	U4	-50E4	J3-U4		X				51/4
CHILLER RETURN TEMPERATURE					White					-51TT2	~	3	○	U5	-50E4	J3-U5		X				51/5
DATA CENTRE FLOW PRESSURE No. 1				White						X1CP2	4	4	○	U6	-50E4	J6-U6		X				51/7
DATA CENTRE FLOW PRESSURE No. 2			White							X1CP2	7	5	○	U7	-50E4	J6-U7		X				51/8
DATA CENTRE RETURN TEMPERATURE		White								-52TT3	~	6	○	U9	-50E4	J20-U9		X				52/3
DATA CENTRE FLOW TEMPERATURE	White									X1CP2	10	7	○	U10	-50E4	J20-U9		X				52/5
VENTURI INLET PRESSURE							Black			-51PT3	1	COM	●		-X3	10		X				51/2
CHILLER FLOW TEMPERATURE						Black				-51TT1	~	COM	●		-50E4	J3GND			X			51/4
CHILLER RETURN TEMPERATURE					Black					-51TT2	~	COM	●		-50E4	J3GND			X			51/5
DATA CENTRE FLOW PRESSURE No. 1				Black						X1CP2	5	COM	●									51/7
DATA CENTRE FLOW PRESSURE No. 2			Black							X1CP2	8	COM	●									51/8
DATA CENTRE RETURN TEMPERATURE		Black								-52TT3	~	COM	○	GND	-50E4	J20GND			X			52/4
DATA CENTRE FLOW TEMPERATURE	Black									X1CP2	11	COM	○		-50E4	J20GND			X			52/5
VENTURI INLET PRESSURE								SH		W51PT3	SHIELD	SCN	●									51/2
CHILLER FLOW TEMPERATURE							SH			W51TT1	SHIELD	SCN	●									51/4
CHILLER RETURN TEMPERATURE						SH				W51TT2	SHIELD	SCN	●									51/5
DATA CENTRE FLOW PRESSURE No. 1					SH					X1CP2	6	SCN	●									51/7
DATA CENTRE FLOW PRESSURE No. 2				SH						X1CP2	9	SCN	●									51/8
DATA CENTRE RETURN TEMPERATURE			SH							W52TT3	SHIELD	SCN	●									52/4
DATA CENTRE FLOW TEMPERATURE										X1CP2	12	SCN	●									52/5

Terminal strip and connector overview

ESSR001E

Terminal strip and connector design.	Text of the strip definition	Terminals					Graphics page of the terminal strip
		first	last	Sum of all PE	Sum of all N	Total number	
-50E4		J4VG19-ID16H		0	0	90	
-51PT3		1	2	0	0	2	
-51PT4		1	2	0	0	2	
-51PT5		1	2	0	0	2	
-40VSD1		13	SHL	0	0	6	100
-40VSD2		13	SHL	0	0	6	101
X1CP2		1	12	0	0	12	102
-X1		1	10	0	0	10	103
-X2		1	10	0	0	10	104
-X3		1	10	1	0	10	105
-X4		1	9	1	0	9	106
-X5		1	SCN	0	0	21	107

Cable overview

ESSS002E

Cable name Cable designation	Source by	Target to	Cable type	Total Cores	Used Cores	Cross-section mm²	Leng. m	Remark	Graphics- Page
W40DI1	-40DI1	-40VSD1	YYNR	4/PE	4/PE	6	-	PUMP - RTP1 LPS ISOLATOR	108
W40DI2	-40DI2	-40VSD2	YYNR	4/PE	4/PE	2.5	-	PUMP - CTP1 RECIRCULATION	109
W40M1			SYNR	4/PE+SHIELD	4/PE+SHIELD	2.5	-	PUMP - RTP1 LPS	112
	-40M1	-40VSD1		4/PE+SHIELD	4/PE	2.5		PUMP - RTP1 LPS	112
	SHIELD	-40VSD1		4/PE+SHIELD	0+SHIELD	2.5		PUMP - RTP1 LPS	112
W40M2			SYNR	4/PE+SHIELD	4/PE+SHIELD	2.5	-	PUMP - CTP1 RECIRCULATION	109
	-40M2	-40VSD2		4/PE+SHIELD	4/PE	2.5		PUMP - CTP1 RECIRCULATION	109
	SHIELD	-40VSD2		4/PE+SHIELD	0+SHIELD	2.5		PUMP - CTP1 RECIRCULATION	109
W40TT5	X1CP2	-40TT5	8761	2+SHIELD	2+SHIELD	0.3	-	CTP1 TEMPERATURE SENSOR	114
W40VSD-M1	-40VSD1	-40VSD2	9841	2+SHIELD	2+SHIELD	0.3	-	MODBUS NETWORK	115
W40VSD-M2	-40VSD2	-X2	9841	2+SHIELD	2+SHIELD	0.3	-	MODBUS NETWORK	116
W40VSD1	-40VSD1	-X1	8761	2+SHIELD	2+SHIELD	0.3	-	VENTURI FLOW PRESSURE	117
W40VSD2	-40VSD2	X1CP2	8761	2+SHIELD	2+SHIELD	0.3	-	CTP1 TEMPERATURE SENSOR	118
W42FS1	-X3	-42FS1	YYNR	4/PE	4/PE	0.75	-	VENTURI THERMAL FLOW SWITCH	119
W42LS1	-X3	-42LS1	YYNR	2	2	0.75	-	LEAK LEVEL SENSOR	120
W42PT1	-X3	-42PT1	8761	2+SHIELD	2	0.3	-	NEGATIVE VENTURI SUCTION No. 1	121
W42PT2	-X3	-42PT2	8761	2+SHIELD	2	0.3	-	NEGATIVE VENTURI SUCTION No. 2	122
W43SV1	-X4	-43SV1	YYNR	3/PE	3/PE	0.75	-	AIR RELEASE SOLENOID VALVE	123
W51PT3	-51PT3	-X5	8761	2+SHIELD	2+SHIELD	0.3	-	VENTURI INLET PRESSURE	124
W51PT4	-51PT4	X1CP2	8761	2+SHIELD	2+SHIELD	0.3	-	DATA CENTRE FLOW PRESSURE No. 1	125
W51PT5	-51PT5	X1CP2	8761	2+SHIELD	2+SHIELD	0.3	-	DATA CENTRE FLOW PRESSURE No. 2	126
W51TT1	-X5	-51TT1	8761	2+SHIELD	2+SHIELD	0.3	-	CHILLER FLOW TEMPERATURE	127
W51TT2	-X5	-51TT2	8761	2+SHIELD	2+SHIELD	0.3	-	CHILLER RETURN TEMPERATURE	128
W52TT3	-X5	-52TT3	8761	2+SHIELD	2+SHIELD	0.3	-	DATA CENTRE RETURN TEMPERATURE	129
W52TT4	X1CP2	-52TT4	8761	2+SHIELD	2+SHIELD	0.3	-	DATA CENTRE FLOW TEMPERATURE	130
WX1-40VSD1	-X1	-40VSD1	YYNR	8/PE	7	1.5	-	40VSD1 CONTROL	131
WX2-40VSD2	-X2	-40VSD2	YYNR	8/PE	7	1.5	-	40VSD2 CONTROL	132
WX5.1	X1CP2	-X5	8761	2+SHIELD	2+SHIELD	0.3	-	DATA CENTRE FLOW PRESSURE No. 1	133
WX5.2	X1CP2	-X5	8761	2+SHIELD	2+SHIELD	0.3	-	DATA CENTRE FLOW PRESSURE No. 2	134
WX5.3	X1CP2	-X5	8761	2+SHIELD	2+SHIELD	0.3	-	DATA CENTRE FLOW TEMPERATURE	135

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W40DI1	YYNR

Remark	No. of cores	Conductor area	Cable length
PUMP - RTP1 LPS ISOLATOR TO VSD	4/PE	6	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - RTP1	40/0	-40DI1	2	1	-40VSD1	91L1	40/0	PUMP - RTP1
PUMP - RTP1	40/0	-40DI1	4	2	-40VSD1	92L2	40/1	PUMP - RTP1
PUMP - RTP1	40/0	-40DI1	6	3	-40VSD1	93L3	40/1	PUMP - RTP1
PUMP - RTP1	40/0	-40DI1	PE	PE	-40VSD1	PE	40/1	PUMP - RTP1

Interconnection diagram

ESSN001E

Cable designation	Cable type
W40DI2	YYNR

Remark	No. of cores	Conductor area	Cable length
PUMP - CTP1 RECIRCULATION ISOLATOR TO VSD	4/PE	2.5	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - CTP1	40/5	-40DI2	2	1	-40VSD2	91L1	40/5	PUMP - CTP1
PUMP - CTP1	40/5	-40DI2	4	2	-40VSD2	92L2	40/5	PUMP - CTP1
PUMP - CTP1	40/5	-40DI2	6	3	-40VSD2	93L3	40/5	PUMP - CTP1
PUMP - CTP1	40/5	-40DI2	PE	PE	-40VSD2	PE	40/6	PUMP - CTP1

Interconnection diagram

ESSN001E

Cable designation	Cable type
W40M1	SYNR

Remark	No. of cores	Conductor area	Cable length
PUMP - RTP1 LPS VSD TO PUMP	4/PE+SHIELD	2.5	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - RTP1	40/0	-40M1	U1	1	-40VSD1	U96	40/0	PUMP - RTP1
PUMP - RTP1	40/0	-40M1	V1	2	-40VSD1	V97	40/1	PUMP - RTP1
PUMP - RTP1	40/0	-40M1	W1	3	-40VSD1	W98	40/1	PUMP - RTP1
PUMP - RTP1	40/0	-40M1	PE	PE	-40VSD1	PE	40/1	PUMP - RTP1
PUMP - RTP1	40/1	SHIELD		SH	-40VSD1	PE	40/1	PUMP - RTP1

Interconnection diagram

ESSN001E

Cable designation	Cable type
W40M2	SYNR

Remark	No. of cores	Conductor area	Cable length
PUMP - CTP1 RECIRCULATION VSD TO PUMP	4/PE+SHIELD	2.5	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - CTP1	40/5	-40M2	U1	1	-40VSD2	U96	40/5	PUMP - CTP1
PUMP - CTP1	40/5	-40M2	V1	2	-40VSD2	V97	40/5	PUMP - CTP1
PUMP - CTP1	40/5	-40M2	W1	3	-40VSD2	W98	40/5	PUMP - CTP1
PUMP - CTP1	40/5	-40M2	PE	PE	-40VSD2	PE	40/6	PUMP - CTP1
PUMP - CTP1	40/6	SHIELD		SH	-40VSD2	PE	40/6	PUMP - CTP1

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W40M2
PUMP - CTP1 RECIRCULATION

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W40TT5	8761

Remark	No. of cores	Conductor area	Cable length
CTP1 TEMPERATURE SENSOR	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - CTP1	40/7	X1CP2	2	Black	-40TT5	+V	40/6	
PUMP - CTP1	40/7	X1CP2	1	White	-40TT5	SIG	40/6	
PUMP - CTP1	40/7	X1CP2	3	SH	W40TT5	SHIELD		

Interconnection diagram

ESSN001E

Cable designation	Cable type
W40VSD-M1	9841

Remark	No. of cores	Conductor area	Cable length
MODBUS NETWORK	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - RTP1	40/3	-40VSD1	68	Blu/Whi	-40VSD2	68.	40/5	
PUMP - RTP1	40/3	-40VSD1	69	Whi/Blu	-40VSD2	69.	40/5	
PUMP - RTP1	40/3	-40VSD1	61	SH	W40VSD-M1	SHIELD		

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W40VSD-M1
MODBUS NETWORK

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W40VSD-M2	9841

Remark	No. of cores	Conductor area	Cable length
MODBUS NETWORK	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - CTP1	40/8	-40VSD2	68	Blu/Whi	-X2	8	40/8	PUMP - CTP1
PUMP - CTP1	40/8	-40VSD2	69	Whi/Blu	-X2	9	40/8	PUMP - CTP1
PUMP - CTP1	40/8	-40VSD2	61	SH	-X2	10	40/8	PUMP - CTP1

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W40VSD-M2
MODBUS NETWORK

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W40VSD1	8761

Remark	No. of cores	Conductor area	Cable length
VENTURI FLOW PRESSURE	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW PRESSURE	40/2	-40VSD1	13	Black	-X1	9	40/2	
FLOW PRESSURE	40/2	-40VSD1	54	White	-X1	8	40/2	
FLOW PRESSURE	40/2	-40VSD1	SHL	SH	-X1	10	40/2	

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W40VSD1
VENTURI FLOW PRESSURE

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W40VSD2	8761

Remark	No. of cores	Conductor area	Cable length
CTP1 TEMPERATURE SENSOR	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
TEMPERTURE SENSOR	40/7	-40VSD2	13	Black	X1CP2	2	40/7	
TEMPERTURE SENSOR	40/7	-40VSD2	54	White	X1CP2	1	40/7	
TEMPERTURE SENSOR	40/7	-40VSD2	SHL	SH	X1CP2	3	40/7	

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W40VSD2
CTP1 TEMPERATURE SENSOR

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W42FS1	YYNR

Remark	No. of cores	Conductor area	Cable length
VENTURI THERMAL FLOW SWITCH	4/PE	0.75	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW SWITCH	42/2	-X3	3	1	-42FS1	1	42/2	
FLOW SWITCH	42/3	-X3	4	2	-42FS1	3	42/2	
FLOW SWITCH	42/3	-X3	5	3	-42FS1	4	42/2	
FLOW SWITCH	42/3	-X3	6	PE	-42FS1	PE	42/2	

Interconnection diagram

ESSN001E

Cable designation	Cable type
W42LS1	YYNR

Remark	No. of cores	Conductor area	Cable length
LEAK LEVEL SENSOR	2	0.75	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
LEAK LEVEL SENSOR	42/1	-X3	1	1	-42LS1	1+VE	42/0	
LEAK LEVEL SENSOR	42/1	-X3	2	2	-42LS1	3DRY	42/0	

Interconnection diagram

ESSN001E

Cable designation	Cable type
W42PT1	8761

Remark	No. of cores	Conductor area	Cable length
NEGATIVE VENTURI SUCTION No.1	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
NEGATIVE VENTURI	42/6	-X3	8	Black	-42PT1	1	42/5	
NEGATIVE VENTURI	42/5	-X3	7	White	-42PT1	2	42/5	
				SH				

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W42PT1
NEGATIVE VENTURI SUCTION No.1

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Interconnection diagram

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Cable designation	Cable type
W42PT2	8761

Remark	No. of cores	Conductor area	Cable length
NEGATIVE VENTURI SUCTION No. 2	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
NEGATIVE VENTURI	42/7	-X3	10	Black	-42PT2	1	42/6	
NEGATIVE VENTURI	42/6	-X3	9	White	-42PT2	2	42/6	
				SH				

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AQUA COOLING SOLUTIONS

W42PT2
NEGATIVE VENTURI SUCTION No.2

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W43SV1	YYNR

Remark	No. of cores	Conductor area	Cable length
AIR RELEASE SOLENOID VALVE	3/PE	0.75	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
SOLENOID VALVE	43/4	-X4	5	1	-43SV1	1	43/4	
SOLENOID VALVE	43/4	-X4	6	2	-43SV1	2	43/4	
SOLENOID VALVE	43/4	-X4	7	PE	-43SV1	PE	43/4	

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W43SV1
AIR RELEASE SOLENOID VALVE

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W51PT3	8761

Remark	No. of cores	Conductor area	Cable length
VENTURI INLET PRESSURE	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
INLET PRESSURE	51/2	-51PT3	1	Black	-X5	COM	51/2	
INLET PRESSURE	51/2	-51PT3	2	White	-X5	1	51/2	
INLET PRESSURE	51/2	W51PT3	SHIELD	SH	-X5	SCN	72/7	

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W51PT3
VENTURI INLET PRESSURE

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0 1 2 3 4 5 6 7 8 9

Interconnection diagram

ESSN001E

Cable designation	Cable type
W51PT4	8761

Remark	No. of cores	Conductor area	Cable length
DATA CENTRE FLOW PRESSURE No.1	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW PRESS. No.1	51/7	-51PT4	1	Black	X1CP2	5	51/7	
FLOW PRESS. No.1	51/7	-51PT4	2	White	X1CP2	4	51/7	
FLOW PRESS. No.1	51/7	W51PT4	SHIELD	SH	X1CP2	6		

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AQUA COOLING SOLUTIONS

W51PT4
DATA CENTRE FLOW PRESSURE No.1

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Interconnection diagram

ESSN001E

Cable designation	Cable type
W51PT5	8761

Remark	No. of cores	Conductor area	Cable length
DATA CENTRE FLOW PRESSURE No. 2	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW PRESS. No. 2	51/8	-51PT5	1	Black	X1CP2	8	51/8	
FLOW PRESS. No. 2	51/8	-51PT5	2	White	X1CP2	7	51/8	
FLOW PRESS. No. 2	51/8	W51PT5	SHIELD	SH	X1CP2	9		

Interconnection diagram

ESSN001E

Cable designation	Cable type
W51TT1	8761

Remark	No. of cores	Conductor area	Cable length
CHILLER FLOW TEMPERATURE	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW TEMPERATURE	51/4	-X5	COM	Black	-51TT1	~	51/4	
FLOW TEMPERATURE	51/4	-X5	2	White	-51TT1	~	51/4	
FLOW TEMPERATURE	51/4	-X5	SCN	SH	W51TT1	SHIELD		

Interconnection diagram

ESSN001E

Cable designation	Cable type
W51TT2	8761

Remark	No. of cores	Conductor area	Cable length
CHILLER RETURN TEMPERATURE	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
RTN. TEMPERATURE	51/5	-X5	COM	Black	-51TT2	~	51/5	
RTN. TEMPERATURE	51/5	-X5	3	White	-51TT2	~	51/5	
RTN. TEMPERATURE	51/5	-X5	SCN	SH	W51TT2	SHIELD		

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W51TT2
CHILLER RETURN TEMPERATURE

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Interconnection diagram

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Cable designation	Cable type
W52TT3	8761

Remark	No. of cores	Conductor area	Cable length
DATA CENTRE RETURN TEMPERATURE	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
RTN. TEMPERATURE	52/4	-X5	COM	Black	-52TT3	~	52/3	
RTN. TEMPERATURE	52/3	-X5	6	White	-52TT3	~	52/3	
RTN. TEMPERATURE	52/4	-X5	SCN	SH	W52TT3	SHIELD		

Interconnection diagram

ESSN001E

Cable designation	Cable type
W52TT4	8761

Remark	No. of cores	Conductor area	Cable length
DATA CENTRE FLOW TEMPERATURE	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW TEMPERATURE	52/5	X1CP2	11	Black	-52TT4	~	52/5	
FLOW TEMPERATURE	52/5	X1CP2	10	White	-52TT4	~	52/5	
FLOW TEMPERATURE	52/5	X1CP2	12	SH	W52TT4	SHIELD		

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W52TT4
DATA CENTRE FLOW TEMPERATURE

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Interconnection diagram

ESSN001E

Cable designation	Cable type
WX1-40VSD1	YYNR

Remark	No. of cores	Conductor area	Cable length
40VSD1 CONTROL CP1 TO VSD	8/PE	1.5	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - RTP1	40/2	-X1	1	1	-40VSD1	18+32	40/0	
PUMP - RTP1	40/2	-X1	2	2	-40VSD1	12+27	40/0	
PUMP - RTP1	40/2	-X1	3	3	-40VSD1	33	40/0	
PUMP - RTP1	40/3	-X1	4	4	-40VSD1	01	40/0	
PUMP - RTP1	40/3	-X1	5	5	-40VSD1	02	40/0	
PUMP - RTP1	40/3	-X1	6	6	-40VSD1	04	40/0	
PUMP - RTP1	40/3	-X1	7	7	-40VSD1	05	40/0	
				PE				

Interconnection diagram

ESSN001E

Cable designation	Cable type
WX2-40VSD2	YYNR

Remark	No. of cores	Conductor area	Cable length
40VSD2 CONTROL CP1 TO VSD	8/PE	1.5	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
PUMP - CTP1	40/6	-X2	1	1	-40VSD2	18+32	40/5	
PUMP - CTP1	40/7	-X2	2	2	-40VSD2	12+32	40/5	
PUMP - CTP1	40/7	-X2	3	3	-40VSD2	33	40/5	
PUMP - CTP1	40/7	-X2	4	4	-40VSD2	01	40/5	
PUMP - CTP1	40/7	-X2	5	5	-40VSD2	02	40/5	
PUMP - CTP1	40/8	-X2	6	6	-40VSD2	04	40/5	
PUMP - CTP1	40/8	-X2	7	7	-40VSD2	05	40/5	
				PE				

Interconnection diagram

ESSN001E

Cable designation	Cable type
WX5.1	8761

Remark	No. of cores	Conductor area	Cable length
DATA CENTRE FLOW PRESSURE No.1	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW PRESS. No.1	51/7	X1CP2	5	Black	-X5	COM	51/2	
FLOW PRESS. No.1	51/7	X1CP2	4	White	-X5	4	51/7	
FLOW PRESS. No.1	51/7	X1CP2	6	SH	-X5	SCN	51/2	

Interconnection diagram

ESSN001E

Cable designation	Cable type
WX5.2	8761

Remark	No. of cores	Conductor area	Cable length
DATA CENTRE FLOW PRESSURE No.2	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW PRESS. No.2	51/8	X1CP2	8	Black	-X5	COM	51/2	
FLOW PRESS. No.2	51/8	X1CP2	7	White	-X5	5	51/8	
FLOW PRESS. No.2	51/8	X1CP2	9	SH	-X5	SCN	51/2	

Changes | Date | Name | Norm
Date | Editor | Tested
15.Jun.2015 | MDC | 22.Jul.2015
Original | CP1
Sub.f.
Sub.b.
AQUA COOLING SOLUTIONS
WX5.2 DATA CENTRE FLOW PRESSURE No.2
P15033
+ | =

Interconnection diagram

ESSN001E

Cable designation	Cable type
WX5.3	8761

Remark	No. of cores	Conductor area	Cable length
DATA CENTRE FLOW TEMPERATURE	2+SHIELD	0.3	-

Function	Page/ path	Destination from	Conn.	Cable core	Destination to	Conn.	Page/ path	Function
FLOW TEMPERATURE	52/5	X1CP2	11	Black	-X5	COM	51/2	
FLOW TEMPERATURE	52/5	X1CP2	10	White	-X5	7	52/5	
FLOW TEMPERATURE	52/5	X1CP2	12	SH	-X5	SCN	51/2	

Changes
Date
Name Norm
Date
Editor MDC 15.Jun.2015
Tested 22.Jul.2015
Original CP1
Sub.f.
Sub.b.
AQUA COOLING SOLUTIONS
WX5.3
DATA CENTRE FLOW TEMPERATURE
P15033
+ =

ESSE002E

AQUA COOLING SOLUTIONS LIMITED

UNIT D4 SEGENSWORTH BUSINESS CENTRE
SEGENSWORTH ROAD, FAREHAM
HAMPSHIRE, PO15 5RQ
Tel.: +44 (0) 845 0941 800 Fax.: +44 (0) 845 0941 900

Customer	: Nautilus Data Technologie
Plant Designation	: HMI
Drawing number	: P15033/HMI
Project Number	:

End User	: Nautilus Data Technologie	Control panel by	: Shellau
		Incoming supply	: 120VAC 60Hz
Site Location	: 1260 Nimitz Avenue Vallejo CA 94592	Feeder	:
		Control voltage	: 24VDC
		Manufacturing date	: November 2015
		Degree of protect.	: IP54
		Panel Location	:

Created on	: 03. Nov. 2015		
Responsible for project	: M. CARMODY		
Date changed	: 04. Nov. 2015	Highest Page No.	: 61
Editor	: MDC	No. of pages	: 12

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Column X: an automaticly created page is manual changed

ESSJ010E

Page	Page designation	Suppl. page field	Date	User	X
1	HMI Control Panel		04. Nov. 2015	M. CARMODY	
2	Table of Contents		04. Nov. 2015	M. CARMODY	x
30	HMI General Standards Technical Information		04. Nov. 2015	M. CARMODY	
31	HMI EN Standards Safety Related Categories.		04. Nov. 2015	M. CARMODY	
40	Control Panel General Arrangement		04. Nov. 2015	M. CARMODY	
41	Control Panel Backplate Layout		04. Nov. 2015	M. CARMODY	
50	110VAC Power Supply Distribution		04. Nov. 2015	M. CARMODY	
51	24VDC Power Supply Distribution		04. Nov. 2015	M. CARMODY	
52	Draytek Router Carel HMI		04. Nov. 2015	M. CARMODY	
53	Carel ir33 Controller		04. Nov. 2015	M. CARMODY	
60	Bill of Materials		04. Nov. 2015	M. CARMODY	
61	Bill of Materials		04. Nov. 2015	M. CARMODY	x

GENERAL SPECIFICATIONS AND TECHNICAL INFORMATION

CONTROL PANEL DETAILS	SPECIFICATION	NOTE COMMENTS: -	PAINT FINISH	SPECIFICATION
TOTAL SIZE OF ENCLOSURE/CONTROL PANEL/S	380(H)x600(W)x210(D)mm	RITTAL: TS RANGE (1200/800mm Width) SECTIONS	GLOSS: SEMI GLOSS: MATT: POWDER-COATED etc	RITTAL STANDARD PAINT FINISH
APPROXIMATE OVERALL WEIGHT	25kg.		EXTERIOR COLOUR (EXCLUDING DOORS)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SYSTEM SUPPLY	1 PHASE/NEUTRAL/EARTH 230VAC/50Hz		EXTERIOR COLOUR (DOORS)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SYSTEM SUPPLY TYPE	TN-S		INTERIOR COLOUR (EXCLUDING BACKPLATE)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SYSTEM SUPPLY REQUIREMENTS	6AMP SUPPLY		INTERIOR COLOUR (INSIDE OF DOORS)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SYSTEM SUPPLY ALLOWANCES FOR DIVERSITY	DIVERSITY 100%FLC CONNECTED		MOUNTING PLATE/S	RITTAL STANDARD (ZINC PLATED)
SYSTEM SUPPLY DESIGN CURRENT REQUIREMENTS			BASE/PLINTH (FITTED)	RITTAL STANDARD (RAL 7022)
MAIN SUPPLY ISOLATOR TYPE 400AMP FUSE DISCONNECTOR			CABLE CHAMBER (NOT FITTED)	RITTAL POWDER-COATED TEXTURED (RAL 7035)
SHORT CIRCUIT CAPACITY				
APPARENT POWER (KVA CONNECTED)		P = V x I x 1.732		
ACTIVE POWER (KW CONNECTED)		P = V x I x 1.732 x 0.8		
DC CONTROL POWER (WATTS CONNECTED)		POWER SUPPLY UNIT 400VAC/24VDC/60AMP/1440W.		
ENCLOSURE LIGHTS & SOCKETS, VOLTAGE	230VAC			
CONTROL & INDICATION VOLTAGE	24VDC			

PROTECTION	SPECIFICATION	COMMENTS: -	PLC EQUIPMENT	SPECIFICATION
BS/EN/IEC STANDARDS IMPLEMENTED	EN292/BSEN954-1/BSEN60204-1/BS7671	NOTE: -ALL APPLICABLE & RELEVANT STANDARDS etc.	PLC MAKE	ALLEN BRADLEY
DEGREE OF ENCLOSURE PROTECTION (IP RATING)	IP54		PLC TYPE	POINT IO
DETAILS OF EQUIPMENT BY BARRIER SCREENING	25VAC/60VDC AND ABOVE (IP20B)	NOTE: -DRY ENVIRONMENTS MAINTAINED (EN60204)	PLC INTERFACE	ETHERNET
EQUIPOTENTIAL BONDING IMPLEMENTED	YES	BS7671 STANDARDS		
AUTOMATIC DISCONNECTION INSTALLED	YES			
MANUFACTURERS SPECIFICATIONS IMPLEMENTED	YES			
EMC STANDARDS REQUIRED (SCREENING)	YES	MANUFACTURERS EMC REQUIREMENTS IMPLEMENTED		
STANDARD LABELS TO BE FITTED	YES	HAZARDS/WARNING SIGNS AND VOLTAGE LABELS		

CONDUCTORS AND TERMINATIONS	SPECIFICATION	COMMENTS: -	CABLE COLOURS	SPECIFICATION
MINIMUM SIZE OF POWER WIRING	2.5mm²		AC 400VAC POWER WIRING	BLACK
MINIMUM SIZE OF CONTROLS & I/O WIRING 24VDC	1.0mm² (I/O 0.5mm²)		AC 230VAC POWER WIRING	BLACK
MINIMUM SIZE OF POWER TERMINALS	4.0mm TERMINATION		PROTECTIVE CONDUCTOR	GREEN/YELLOW
MINIMUM SIZE OF CONTROL TERMINALS	2.5mm TERMINATION		AC CONTROL CIRCUITS +	RED
MAIN POWER BUSBAR SIZE	15x5mm COPPER BAR		AC CONTROL CIRCUITS -	WHITE/RED
MAIN EARTH BUSBAR SIZE	30x15mm COPPER BAR		DC CONTROL CIRCUITS +	DARK BLUE
EARTH BUSBAR POSITIONS	BOTTOM OF PANEL/S		DC CONTROL CIRCUITS -	WHITE/BLUE
METHOD OF TERMINATING OUTGOING PROTECTIVE CONDUCTORS	BUSBAR AND/OR PE TERMINALS		NEUTRAL CIRCUITS	LIGHT BLUE
EXTERNAL CABLES, ENTRY POSITION	BOTTOM/TOP ENTRY		LIVE SIDE OF ISOLATOR CIRCUITS	ORANGE
METHOD OF FIXING/SUPPORTING OUTGOING CABLES	CABLE TRUNKING/TRAY		EXTERNALLY FED INTERLOCKS CIRCUITS (AC)	ORANGE
SCHEMATIC SYMBOLS & CONTACT REFERENCE NUMBERS Etc	SYMBOLS BS EN 60617	EQUIPMENT PAGE-PATH NUMBERING.	EXTERNALLY FED INTERLOCKS CIRCUITS (DC)	ORANGE

GENERAL COMMENTS: -

EN SAFETY RELATED CATEGORIES

EN954-1 SAFETY RELATED CIRCUIT CATEGORIES.		MACHINERY AND EQUIPMENTS.	BSEN 60204-1 SAFETY RELATED STOPPING CATEGORIES.	
CATEGORY "B"	PLC INPUT CONTROLLED. PLC OUTPUT CONTROLLED. PLC OUTPUTS FOR RUN ENABLE RELAY. PLC OUTPUTS FOR INVERTER POWER CONTACTORS.	MOTOR CONTACTORS INVERTER DRIVE UNITS CONTROL PANEL EMERGENCY STOP DRIVE BOX EMERGENCY STOP OP STATION EMERGENCY STOP	CATEGORY "2"	IMMEDIATE STOP (PLC CONTROLLED) CONTACTORS.
CATEGORY "1-2"	DUAL CHANNEL INPUT TO SAFETY RELAY. SINGLE CHANNEL OUTPUT FROM SAFETY RELAY TO HARDWIRED CONTACTOR.	MOTOR CONTACTORS INVERTER DRIVE UNITS CONTROL PANEL EMERGENCY STOP	CATEGORY "0"	IMMEDIATE STOP (SAFETY CONTACTS) DUAL CHANNEL HARDWIRED CONTROLLED TO CONTACTOR WITH DIVERSITY CIRCUITS.

GENERAL DUTY TENANCE NOTE:

ISOLATE All MACHINERY AND/OR EQUIPMENT AT ISOLATION POINTS BEFORE UNDERTAKING ANY DUTY TENANCE WORK.

0	1	2	3	4	5	6	7	8	9

40ENC1

52HMI1

CAREL HMI

MANUFACTURING NOTE: -
ALL DIMENSIONS AND POSITIONS
ARE APPROXIMATE SCALE 1:2
(A3 PRINT SIZE)

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			Date	03. Nov. 2015	HMI		AQUA COOLING SOLUTIONS	Control Panel General Arrangement	P15033/HMI	=
			Editor	M. CARMODY						+
			Tested	04. Nov. 2015					REV. B	ISSUED FOR MANUFACTURE 04/11/2015
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			P. 40 / 61 P.

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			Date	03. Nov. 2015	HMI		AQUA COOLING SOLUTIONS	Control Panel Backplate Layout	P15033/HMI
			Editor	M. CARMODY					REV. B
			Tested	04. Nov. 2015					ISSUED FOR MANUFACTURE 04/11/2015
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.		

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			Date	03. Nov. 2015	HMI		AQUA COOLING SOLUTIONS	110VAC Power Supply Distribution	P15033/HMI
			Editor	M. CARMODY					REV. B
			Tested	04. Nov. 2015					ISSUED FOR MANUFACTURE 04/11/2015
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.		

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			Date	03. Nov. 2015	HMI		AQUA COOLING SOLUTIONS	24VDC Power Supply Distribution	P15033/HMI
			Editor	M. CARMODY					REV. B
			Tested	04. Nov. 2015					ISSUED FOR MANUFACTURE 04/11/2015
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.		

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			Date		HMI		AQUA COOLING SOLUTIONS	Draytek Router Carel HMI	P15033/HMI
			Editor	MDC					REV. B
			Tested	04. Nov. 2015					ISSUED FOR MANUFACTURE 04/11/2015
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.		

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			Date		HMI		AQUA COOLING SOLUTIONS	Carel ir33 Controller	P15033/HMI	=
			Editor	MDC						+
			Tested	04. Nov. 2015					REV. B	ISSUED FOR MANUFACTURE 04/11/2015
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.			P. 53 / 61 P.

DEVICE DESIGNATION	DESCRIPTION	MODEL TYPE/PART №	MANUFACTURER	UNIT QUANTITY	SCHEMATIC PAGE. PATH	LINE CODE	ITEM №
40ENC1	600x380x210mm AE ENCLOSURE	AE 1039.500	Rittal Ltd	1	40. 0		1
41TR1	40X80mm NARROW TRUNKING	E154	Lovato Electric	1	41. 2		2
41TR3	40X80mm NARROW TRUNKING	E154	Lovato Electric	1	41. 2		3
41DR1	35mm X 7.5mm TOP HAT SLOTTED RAIL NORMAL DUTY	TS35S	Lovato Electric	1	41. 5		4
41TR3	40X80mm NARROW TRUNKING	E154	Lovato Electric	1	41. 7		5
50Q1	3 POLE 25A SIRCO M LOADBREAK SWITCH	2200 3002	SOCOMEC	1	50. 1		6
50Q1	DIRECT HANDLE - BLUE 16...80	2299 5012	SOCOMEC	1	50. 1		7
50Q1	TERMINAL SHROUD 3 POLE 16-40A	2294 3005	SOCOMEC	1	50. 1		8
50EB1	M8x40mm BRASS HEX BOLT	M8X40	Merlin	1	50. 2		9
50EB1	M8 CUT WASHER	M8S	Merlin	1	50. 2		10
50EB1	M8 BRASS WASHER	M8W	Merlin	2	50. 2		11
50EB1	M8 BRASS NUT	M8N	Merlin	2	50. 2		12
50EB2	4mm PE Terminal	57.504.9055.0	WIELAND ELECTRIC	3	50. 3		13
50F1	4A 1 POLE AC C CURVE MCB	AB1489-M1C040	ALLEN BRADLEY	1	50. 7		14
50E1	SWITCHED SINGLE SOCKET	811 27	LEGRAND	1	50. 7		15
51F2	6A 1 POLE AC C CURVE MCB	AB1489-M1C060	ALLEN BRADLEY	1	51. 1		16
51PS1	85...264VAC 24VDC POWER SUPPLY 5A	AB1606XLE120E	ALLEN BRADLEY	1	51. 1		17
51F3	6A 1 POLE DC C CURVE MCB	AB1492-D1C060	ALLEN BRADLEY	1	51. 1		18
52SW1	ROUTER	VIGOR 2830N	Draytek	1	52. 2		19
RJ2	RJ45 TO RJ45 PATCHCORD	AB1585JM4TBJM2	ALLEN BRADLEY	1	52. 4		20

			Date	04. Nov. 2015	HMI	AQUA COOLING SOLUTIONS	Bill of Materials
			Editor	TMC			
			Tested	04. Nov. 2015			
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.

P15033/HMI
REV. B
ISSUED FOR MANUFACTURE 04/11/2015

DEVICE DESIGNATION	DESCRIPTION	MODEL TYPE/PART №	MANUFACTURER	UNIT QUANTITY	SCHEMATIC PAGE. PATH	LINE CODE	ITEM №
52HMI1	HMI TERMINAL	PGDT13000FR10	Carel	1	52. 6		21
X1	4mm Terminal	57.504.0055.0	WIELAND ELECTRIC	3	52. 8		22
X1	2.5/4mm END PLATE	07.311.0155.0	WIELAND ELECTRIC	1	52. 8		23
X1	TERMINAL END STOP	Z5.522.8555.0	WIELAND ELECTRIC	2	52. 8		24
53E2	DIGITAL CONTROLER	DN33V9MR20	Carel	1	53. 1		25
53E2	IR33 DIN SERIAL BOARD RS485, DIISPLAY & PRG KEY CONNECTOR	IROPZSER30	Carel	1	53. 1		26

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			Date	04. Nov. 2015	HMI	AQUA COOLING SOLUTIONS	Bill of Materials
			Editor	TMC			
			Tested	04. Nov. 2015			
Changes	Date	Name	Norm		Original	Sub. f.	Sub. b.

P15033/HMI

REV. B

ISSUED FOR MANUFACTURE
04/11/2015

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E

NCSE pump manual

This appendix reproduces the English language section of the NCSE pump manual.

LOWARA

NSCE

NSCS

NSC2

Applicare qui il codice a barre

Apply the adhesive bar code nameplate here

it	Manuale di installazione, uso e manutenzione	2
en	Installation, Operation, and Maintenance Manual	13
fr	Manuel d'installation, d'utilisation et d'entretien	23
de	Montage-, Betriebs- und Wartungshandbuch	34
es	Manual de instalación, funcionamiento y mantenimiento	46
pt	Manual de Instalação, Operação e Manutenção	57
nl	Handleiding voor installatie, bediening en onderhoud	68
da	Installations-, betjenings- og vedligeholdelseshåndbog	80
no	Installasjons-, drifts- og vedlikeholdshåndbok	90
sv	Installations-, drift- och underhållsmanual	100
fi	Asennus-, käyttö- ja huolto-opas	110
is	Handbók um uppsetningu, rekstur og viðhald	121
et	Paigaldamise, kasutamise ja hooldamise juhend	130
lv	Uzstādīšanas, ekspluatācijas un tehniskās apkopes rokasgrāmata	140
lt	Montavimo, eksploatavimo ir techninės priežiūros vadovas	151
pl	Podręcznik instalacji, eksploatacji i konserwacji	162
cs	Návod k instalaci, provozu a údržbě	173
sk	Návod na inštaláciu, obsluhu a údržbu	184
hu	Beszerelési, működtetési és karbantartási útmutató	194
ro	Manual de instalare, exploatare şi întreţinere	205
bg	Ръководство за Инсталиране, Експлоатация и Обслужване	216
sl	Navodila za vgradnjo, delovanje in vzdrževanje	228
hr	Priručnik za instaliranje, rad i održavanje	238
sr	Priručnik za instaliranje, rad i održavanje	249
el	Εγχειρίδιο εγκατάστασης, λειτουργίας και συντήρησης	259
tr	Kurulum, Çalıştırma ve Bakım Kılavuzu	271
ru	Руководство по установке, эксплуатации и техническому обслуживанию	281
uk	Посібник зі встановлення, експлуатації та технічного обслуговування	293
ar	دليل التركيب والتشغيل والصيانة	305

cod. 001080072 rev. C ed. 03/2016

Causa	Soluzione
I cuscinetti del motore sono usurati.	Rivolgersi al rappresentante di vendita e assistenza di zona.
Presenza di corpi estranei	Rivolgersi al rappresentante di vendita e assistenza di zona.

Causa	Soluzione
all'interno della pompa.	
Il girante strisscia contro l'anello di usura	Rivolgersi al rappresentante di vendita e assistenza di zona.

Per ogni situazione non contemplata, fare riferimento al rappresentante di vendita e assistenza di zona.

1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance

CAUTION:
Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:
Save this manual for future reference, and keep it readily available at the location of the unit.

1.1.1 Inexperienced users

WARNING:
This product is intended to be operated by qualified personnel only.

Be aware of the following precautions:

- This product is not to be used by anyone with physical or mental disabilities, or anyone without the relevant experience and knowledge, unless they have received instructions on using the equipment and on the associated risks or are supervised by a responsible person.
- Children must be supervised to ensure that they do not play on or around the product.

1.2 Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product and its surroundings
- Product malfunction

Hazard levels

Hazard level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	Notices are used when there is a risk of equipment damage or decreased performance, but not personal injury.

Special symbols

Some hazard categories have specific symbols, as shown in the following table.

Electrical hazard	Magnetic fields hazard
Electrical Hazard:	**CAUTION:**

Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:

CAUTION:

Description of user and installer symbols

	Specific information for personnel in charge of installing the product in the system (plumbing and/or electrical aspects) or in charge of maintenance.
	Specific information for users of the product.

Instructions

The instructions and warnings that are provided in this manual concern the standard version, as descri-

bed in the sales document. Special version pumps may be supplied with supplementary instruction leaflets. Refer to sales contract for any modifications or special version characteristics. For instructions, situations, or events that is not considered in this manual or the sales document, contact the nearest Service Center.

1.3 Disposal of packaging and product

Observe the local regulations and codes in force regarding sorted waste disposal.

1.4 Warranty

For information about warranty, see the sales contract.

1.5 Spare parts

WARNING:
Only use original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the guarantee.

CAUTION:
Always specify the exact product type and part number when requesting technical information or spare parts from the Sales and Service Department.

For more information about the product's spare parts, visit sales network's website.

1.6 DECLARATIONS OF CONFORMITY

1.6.1 EC Declaration of Conformity (Original)

Xylem Service Italia S.r.l., with headquarters in Via Vittorio Lombardi 14 - 36075 Montecchio Maggiore VI - Italy, hereby declares that the product:

Electric pump unit (see label on first page)

fulfills the relevant provisions of the following European directives:

- Machinery 2006/42/EC (ANNEX II - natural or legal person authorised to compile the technical file: Xylem Service Italia S.r.l.)
- Eco-design 2009/125/EC, Regulation (EC) No 640/2009 & Regulation (EU) No 4/2014 (Motor 3 ~, 50 Hz, PN ≥ 0,75 kW) if IE2 or IE3 marked, Regulation (EU) No 547/2012 (Water pump) if MEI marked

and the following technical standards

- EN ISO 12100:2010, EN 809:1998+A1:2009, EN 60204-1:2006+A1:2009
- EN 60034-30:2009, EN 60034-30-1:2014

Montecchio Maggiore, 11.03.2016
Amedeo Valente
(Director of Engineering and R&D)
rev.01

1.6.2 EU Declaration of Conformity (No EMCD01)

1. Apparatus model/Product:
   see label on first page
2. Name and address of the manufacturer:
   Xylem Service Italia S.r.l.
   Via Vittorio Lombardi 14
   36075 Montecchio Maggiore VI
   Italy
3. This declaration of conformity is issued under the sole responsibility of the manufacturer.
4. Object of the declaration:
   electric pump
5. The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:
   Directive 2014/30/EU of 26 February 2014
   (electromagnetic compatibility)
6. References to the relevant harmonised standards used or references to the other technical specifications, in relation to which conformity is declared:
   EN 61000-6-1:2007, EN 61000-6-3:2007
   +A1:2011
7. Notified body: -
8. Additional information: -

Signed for and on behalf of:
Xylem Service Italia S.r.l.

Montecchio Maggiore, 11.03.2016
Amedeo Valente
(Director of Engineering and R&D)
rev.01

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2 Transportation and Storage

2.1 Inspect the delivery

1. Check the outside of the package for evident signs of damage.
2. Notify our distributor within eight days of the delivery date, if the product bears visible signs of damage.

Unpack the unit

1. Follow applicable step:
   – If the unit is packed in a carton, then remove the staples and open the carton.
   – If the unit is packed in a wooden crate, then open the cover while paying attention to the nails and straps.
2. Remove the securing screws or the straps from the wooden base.

2.1.1 Inspect the unit

1. Remove packing materials from the product.
   Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.

3. If applicable, unfasten the product by removing any screws, bolts, or straps.

   For your personal safety, be careful when you handle nails and straps.

4. Contact the local sales representative if there is any issue.

2.2 Transportation guidelines

Precautions

WARNING:

- Observe accident prevention regulations in force.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.

Check the gross weight that is indicated on the package in order to select proper lifting equipment.

Position and fastening

The pump or pump unit can be transported only horizontally. Make sure that the pump or pump unit is securely fastened during transportation and cannot roll or fall over.

WARNING:

Do not use eyebolts screwed on the motor for handling the whole electric pump unit.

Do not use the shaft end of the pump or of the motor to handle the pump, the motor or the unit.

- Eyebolts screwed onto the motor may be exclusively used to handle the individual motor or, in case of a not balanced distribution of weights, to partially lift the unit vertically starting from a horizontal displacement.

Pump unit must always be fixed and transported as shown in *Figure 5* (page 333), and the pump without motor must be fixed and transported as shown in *Figure 6* (page 333).

In this last case remove coupling guards from drive lantern and cross the lifting ropes/bands.

2.3 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

Protect the product against humidity, heat sources, and mechanical damage.

NOTICE:

Do not place heavy weights on the packed product.

2.3.1 Long-term storage

If the unit is stored for more than 6 months, these requirements apply:

- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.
- Rotate the shaft by hand several times at least every three months.

For questions about possible long-term storage treatment services, please contact your local sales and service representative.

Ambient temperature

The product must be stored at an ambient temperature from -5°C to +40°C (23°F to 104°F).

3 Product Description

3.1 Pump design

The pump is a horizontal pump with volute casing close coupled to standard electric motors.

The pump can be used for handling:

- Cold or warm water
- Clean liquids
- Liquids which are not chemically and mechanically aggressive to the pump materials.

Intended use

The pump is suitable for:

- Water supply and water treatment
- Cooling and hot water supply in industries and building services
- Irrigation and sprinkler systems
- Heating systems

Additional uses for optional material:

- District heating
- General industry

Improper use

WARNING:

Improper use of the pump may create dangerous conditions and cause personal injury and damage to property.

An improper use of the product leads to the loss of the warranty.

Examples of improper use:

- Liquids not compatible with the pump construction materials
- Hazardous liquids (such as toxic, explosive, flammable, or corrosive liquids)
- Potable liquids other than water (for example, wine or milk)

Examples of improper installation:

- Hazardous locations (such as explosive, or corrosive atmospheres).
- Location where the air temperature is very high or there is poor ventilation.
- Outdoor installations where there is no protection against rain or freezing temperatures.

DANGER:

Do not use this pump to handle flammable and/or explosive liquids.

NOTICE:

- Do not use this pump to handle liquids containing abrasive, solid, or fibrous substances.
- Do not use the pump for flow rates beyond the specified flow rates on the data plate.

Special applications

Contact the local sales and service representative in the following cases:

- If the density and/or viscosity value of the pumped liquid exceeds the value of water, such as water with glycol; as it may require a more powerful motor.
- If the pumped liquid is chemically treated (for example softened, deionized, demineralized etc.).
- Any situation that is different from the ones that is described and relate to the nature of the liquid.

3.2 Pump denomination

See *Figure 2* (page 318) for an explanation of the denomination code for the pump and one example.

3.3 Nameplate

The nameplate is a metal label that is located on the pump body or on drive lantern depending on model. The name plate lists key product specifications. For more information, see *Figure 1* (page 313)

The nameplate provides information regarding the impeller and casing material, the mechanical seal and their materials. For more information, see *Figure 3* (page 328).

IMQ or TUV or IRAM or other marks (for electric pump only)

Unless otherwise specified, for products with a mark of electrical-related safety approval, the approval refers exclusively to the electrical pump.

3.4 Pump description

- Connection dimensions according EN 733 (models 32-125…-200; 40-125…-250; 50-125…-250; 65-125…-315;80-160…-315; 100-200…-400; 125-250…-400; 150-315…-400).
- Volute casing pump with back pull out power end.

3.5 Material

The metallic parts of the pump that come in contact with water are made of the following:

Material code	Material casing / impeller	Standard/ Optional
CC	Cast iron/Cast iron	Standard
CB	Cast iron/ Bronze	Standard
CS	Cast iron/ Stainless steel	Standard
CN	Cast iron/ Stainless steel	Standard
DC	Ductil iron / Cast iron	Standard
DB	Ductil iron / Bronze	Standard
DN	Ductil iron / Stainless steel	Standard
NN	Stainless steel / Stainless steel	Standard
RR	Duplex/Duplex	Opzional

3.6 Mechanical seal

Unbalanced single mechanical seal acc. EN 12756, version K.

3.7 Application limits

Maximum working pressure

Figure 4 (page 332) shows the maximum working pressure depending on the pump model and the temperature of the pumped liquid.

$P_{1max} + P_{max} \leq PN$

P_{1max} Maximum inlet pressure

P_{max} Maximum pressure generated by the pump

PN Maximum operating pressure

Liquid temperature intervals

Figure 4 (page 332) shows the working temperature ranges.

For special requirements, contact the Sales and Service Department.

Maximum number of starts per hour

kW	0.25 - 3.00	4.00 - 7.50	11 - 15	18.5 - 22	30 - 37	45 - 75	90 - 160
Starts per hour	60	40	30	24	16	8	4

Noise level

For the sound pressure levels of pump equipped with standard supplied motor, see *Table 7* (page 333).

4 Installation

Precautions

WARNING:

- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Always refer to the local and/or national regulations, legislation, and codes in force regarding the selection of the installation site, plumbing, and power connections.

Electrical Hazard:

- Make sure that all connections are performed by qualified installation

technicians and in compliance with the regulations in force.
- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.

Grounding (earthing)

Electrical Hazard:
- Always connect the external protection conductor to ground (earth) terminal before making other electrical connections.
- You must ground (earth) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the ground (earth) lead to verify that it is connected correctly.
- If the motor cable is jerked loose by mistake, the ground (earth) conductor should be the last conductor to come loose from its terminal. Make sure that the ground (earth) conductor is longer than the phase conductors. This applies to both ends of the motor cable.
- Add additional protection against lethal shock. Install a high-sensitivity differential switch (30 mA) [residual current device RCD].

4.1 Facility requirements

4.1.1 Pump location

DANGER:
Do not use this unit in environments that may contain flammable/explosive or chemically aggressive gases or powders.

Guidelines

Observe the following guidelines regarding the location of the product:
- Make sure that no obstructions hinder the normal flow of the cooling air that is delivered by the motor fan.
- Make sure that the installation area is protected from any fluid leaks, or flooding.
- If possible, place the pump slightly higher than the floor level.
- The ambient temperature must be between 0°C (+32°F) and +40°C (+104°F).
- The relative humidity of the ambient air must be less than 50% at +40°C (+104°F).
- Contact the Sales and Service Department if:
  - The relative air humidity conditions exceed the guidelines.
  - The room temperature exceeds +40°C (+104°F).
  - The unit is located more than 1000 m (3000 ft) above the sea level. The motor performance may need to be de-rated or replaced with a more powerful motor.

For information about which value to de-rate the motor with, see *Table 8* (page 337).

Pump positions and clearance

Provide adequate light and clearance around the pump. Make sure that it is easily accessible for installation and maintenance operations.

Installation above liquid source (suction lift)

The theoretical maximum suction height of any pump is 10.33m. In practice, the following affect the suction capacity of the pump:
- Temperature of the liquid
- Elevation above the sea level (in an open system)
- System pressure (in a closed system)
- Resistance of the pipes
- Own intrinsic flow resistance of the pump
- Height differences

The following equation is used to calculate the maximum height above the liquid level which the pump can be installed:

$(p_b*10.2 - Z) \geq NPSH + H_f + H_v + 0.5$

p_b	Barometric pressure in bar (in closed system is system pressure)
NPSH	Value in meter of the pump intrinsic flow resistance
H_f	Total losses in meters caused by passage of liquid in the suction pipe of the pump
H_v	Steam pressure in meters that correspond to the temperature of the liquid T °C
0.5	Recommended safety margin (m)
Z	Maximum height at which the pump can be installed (m)

$(p_b*10.2 - Z)$ must always be a positive number.

For more information, see *Figure 9* (page 337).

NOTICE:
Do not exceed the pumps suction capacity as this could cause cavitation and damage the pump.

4.1.2 Piping requirements

Precautions

WARNING:
- Use pipes suited to the maximum working pressure of the pump. Failure to do so can cause the system to rupture, with the risk of injury.
- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.

NOTICE:
Observe all regulations issued by authorities having jurisdiction and by companies managing the public water supplies if the pump is connected to a public water system. If required, install appropriate backflow-prevention device on the suction side.

Piping checklist

Check that the following requirements are met:

- All piping is independently supported, piping must not place a burden on the unit.
- Flexible pipes or unions are used, in order to avoid transmission of pump vibrations to the pipes and vice versa.
- Use wide bends, avoid using elbows which cause excessive flow resistance.
- The suction piping is perfectly sealed and air-tight.
- If the pump is used in an open circuit, then the diameter of the suction pipe is suited to the installation conditions. The suction pipe must not be smaller than the diameter of the suction port.
- If the suction piping must be larger than the suction side of the pump, then an eccentric pipe reducer is installed.
- If the pump is placed above liquid level, a foot valve is installed at the end of the suction piping.
- The foot valve is fully immersed into the liquid so that air cannot enter through the suction vortex, when the liquid is at the minimum level and the pump is installed above the liquid source.
- Appropriately sized on-off valves are installed on the suction piping and on the delivery piping (downstream to the check valve) for regulation of the pump capacity, for pump inspection, and for maintenance.
- Appropriately sized on-off valve is installed on the delivery piping (downstream to the check valve) for regulation of the pump capacity, for pump inspection, and for maintenance.
- In order to prevent back flow into the pump when pump is turned off a check valve is installed on the delivery piping.

WARNING:

Do not use the on-off valve on the discharge side in the closed position in order to throttle the pump for more than a few seconds. If the pump must operate with the discharge side closed for more than a few seconds, a bypass circuit must be installed to prevent overheating of the liquid inside the pump.

For illustrations that show the piping requirements, see *Figure 10* (page 338) and *Figure 11* (page 338).

4.2 Electrical requirements

- The local regulations in force overrule these specified requirements.
- In the case of fire fighting systems (hydrants and/or sprinklers), check the local regulations in force.

Electrical connection checklist

Check that the following requirements are met:

- The electrical leads are protected from high temperature, vibrations, and collisions.
- The power supply line is provided with:
  - A short-circuit protection device
  - A mains isolator switch with a contact gap of at least 3 mm

The electrical control panel checklist

NOTICE:

The control panel must match the ratings of the electric pump. Improper combinations could fail to guarantee the protection of the motor.

Check that the following requirements are met:

- The control panel must protect the motor against overload and short-circuit.
- Install the correct overload protection (thermal relay or motor protector).

Pump Type	Protection
Single phase standard electric pump ≤ 2.2 kW	– Built-in automatic reset thermal-amperometric protection (motor protector) – Short circuit protection (must be supplied by the installer)[3]
Three phase electric pump[4]	– Thermal protection (must be supplied by the installer) – Short circuit protection (must be supplied by the installer)

- The control panel must be equipped with a dry-running protection system to which a pressure switch, float switch, probes, or other suitable device is connected.
- The following devices are recommended for use on the suction side of the pump:
  - When the liquid is pumped from a water system, use a pressure switch.
  - When the liquid is pumped from a storage tank or reservoir, use a float switch or probes.
- When thermal relays are used, relays that are sensitive to phase failure are recommended.

The motor checklist

WARNING:

- Read the operating instructions in order to ensure whether a protection device is provided if another motor other than the standard is used.
- If the motor is equipped with automatic thermal protectors, be aware of the risk of unexpected starts in connection to overload. Do not use such motors for fire-fighting applications.

NOTICE:

- Only use dynamically balanced motors with a half-sized key in the shaft extension (IEC 60034-14) and with normal vibration rate (N).
- The mains voltage and frequency must agree with the specifications on the data plate.

In general, motors can operate under the following mains voltage tolerances:

[3] fuses aM (motor starting), or magneto-thermal switch with curve C and Icn ≥ 4,5 kA or other equivalent device.

[4] Overload thermal relay with trip class 10A + fuses aM (motor starting) or motor protection magneto-thermal switch with starting class 10A.

Frequency Hz	Phase ~	UN [V] ± %
50	1	220 – 240 ± 6
	3	230/400 ± 10
		400/690 ± 10
60	1	220 – 230 ± 6
	3	220/380 ± 5
		380/660 ± 10

Use cable according to rules with 3 leads (2+earth/ground) for single phase versions and with 4 leads (3+earth/ground) for three phase version.

4.3 Install the pump

4.3.1 Mechanical installation

Check the following before installation:

- Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1.
- The mounting surface must have set and must be completely horizontal and even.
- Observe the weights indicated.

Install the pump set

For examples of horizontal and vertical installations, see *Figure 12* (page 340).

Check that the foundation has been prepared in accordance with the dimensions given in the outline drawing/general arrangement drawing.

Type	Motor Size	Number of Poles	Type of Fastening
A	Up to 132	2– and 4–pole	Mount on ground using the volute casing feet.
B	From 160 to 200	2–pole	Mount on ground using the pump and motor feet. Shims are required under the pump and motor feet.
	From 160 to 280	4–pole	
C	250	2–pole	Mount on ground using the pump and motor feet. Shims are required under the pump and motor feet.
D	Up to 132	2– and 4–pole	Mount on ground using the volute casing feet.
E	From 160 to 280	2– and 4–pole	Mount on ground using the motor feet

1. Position the pump set on the foundation and level it with the help of a spirit level that is placed on the discharge port.

   The permissible deviation is 0.2 mm/m.
2. Remove the plugs covering the ports.
3. Align the pump and piping flanges on both sides of the pump. Check the alignment of the bolts.
4. Fasten the piping with bolts to the pump. Do not force the piping into place.
5. Use shims for height compensation, if necessary.
6. Tighten the foundation bolts evenly and firmly.

Note:

- If the transmission of vibrations can be disturbing, provide vibration-damping supports between the pump and the foundation.

4.3.2 Piping checklist

Check that the following are adhered to:

- The suction lift line has been laid with a rising slope, at positive suction head line with a downward slope towards the pump.
- The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump ports.
- The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

CAUTION:

Welding beads, scale and other impurities in the piping damage the pump.

- Free the piping from any impurities.
- If necessary, install a filter.

4.3.3 Electrical installation

1. Remove the screws of the terminal box cover.
2. Connect and fasten the power cables according to the applicable wiring diagram.

   For wiring diagrams, see *Figure 13* (page 341). The diagrams are also available on the back of the terminal box cover.

   a) Connect the ground (earth) lead.

   Make sure that the ground (earth) lead is longer than the phase leads.

   b) Connect the phase leads.
3. Mount the terminal box cover.

NOTICE:

Tighten the cable glands carefully to ensure protection against cable slipping and humidity entering the terminal box.

4. If the motor is not equipped with automatic reset thermal protection, then adjust the overload protection according to the list below.
   - If the motor is used with full load, then set the value to the nominal current value of electric pump (data plate)
   - If the motor is used with partial load, then set the value to the operating current (for example measured with a current pincer).
   - If the pump has a star-delta starting system, then adjust the thermal relay to 58% of the nominal current or operating current (only for three-phase motors).

5 Commissioning, Startup, Operation, and Shutdown

Precautions

WARNING:
- Make sure that the drained liquid does not cause damage or injuries.
- The motor protectors can cause the motor to restart unexpectedly. This could result in serious injury.
- Never operate the pump without the coupling guard correctly installed.

CAUTION:
- The outer surfaces of the pump and motor can exceed 40ºC (104ºF) during operation. Do not touch with any part of the body without protective gear.
- Do not put any combustible material near the pump.

NOTICE:
- Never operate the pump below the minimum rated flow, when dry, or without prime.
- Never operate the pump with the delivery ON-OFF valve closed for longer than a few seconds.
- Never operate the pump with the suction ON-OFF valve closed.
- Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
- The sum of the pressure on the suction side (mains, gravity tank) and the maximum pressure that is delivered by the pump must not exceed the maximum working pressure that is allowed (nominal pressure PN) for the pump.
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.

5.1 Fill the pump

For information about additional pump connections, see *Figure 14* (page 341).

Installations with liquid level above the pump (suction head)

For an illustration that shows where pump plugs are, see *Figure 15* (page 343).

1. Close the on-off valve located downstream from the pump.
2. Remove the fill (3) or gauge plug (1) and open the on/off valve upstream until the water flows out of the hole.

a) Close the fill (3) or gauge plug (1).

Installations with liquid level below the pump (suction lift)

For an illustration that shows where pump plugs are, see *Figure 16* (page 345).

1. All pipe system empty:

a) Open the on-off valve located upstream from the pump.
b) Remove the fill plug (3) and the gauge plug (1). Use a funnel to fill the pump through the fill hole until the water flows out of this hole.
c) Tighten the fill plug (3) and the gauge plug (1).

2. Filled discharge pipe system:

a) Open the on-off valve located upstream from the pump and open the on-off valve downstream.
b) Remove the gauge plug (1) until water flows out of this hole.
c) Tighten the gauge plug (1).

5.2 Check the rotation direction (three-phase motor)

Follow this procedure before start-up.

1. Locate the arrows on the adaptor or the motor fan cover to determine the correct rotation direction.
2. Start the motor.
3. Quickly check the direction of rotation through the coupling guard or through the motor fan cover.
4. Stop the motor.
5. If the rotation direction is incorrect, then do as follows:

a) Disconnect the power supply.
b) In the terminal board of the motor or in the electric control panel, exchange the position of two of the three wires of the supply cable.

   For the wiring diagrams, see *Figure 13* (page 341).

c) Check the direction of rotation again.

5.3 Start the pump

The responsibility for checking the correct flow and the temperature of the pumped liquid rests with the installer or owner.

Before starting the pump, make sure that:
- The pump is correctly connected to the power supply.
- The pump is correctly filled according to instructions in *Fill the pump* (chapter 5).
- The on-off valve located downstream from the pump is closed.

1. Start the motor.
2. Gradually open the on-off valve on the discharge side of the pump.

   At the expected operating conditions, the pump must run smoothly and quietly. If not, refer to *Troubleshooting* (page 21).

6 Maintenance

Precautions

Electrical Hazard:

Disconnect and lock out electrical power before installing or servicing the unit.

WARNING:

- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Make sure that the drained liquid does not cause damage or injuries.

6.1 Service

If the user wishes to schedule regular maintenance deadlines, they are dependent on the type of pumped liquid and on the operating conditions of the pump.

Contact the local sales and service representative for any requests or information regarding routine maintenance or service.

Extraordinary maintenance may be necessary to clean the liquid end and/or replace worn parts.

Motor bearings

After approximately five years, the grease in the motor bearings is so aged that a replacement of the bearings is recommended. The bearings must be replaced after 25000 operating hours or according to the motor supplier maintenance instructions, whichever is shorter.

Motor with regreasable bearings

Follow motor supplier maintenance instructions.

6.2 Inspection checklist

Check for leakage of the mechanical seal. Replace the mechanical seal if leakage is found.

6.3 Disassemble and replace the pump parts

For more information about spare parts and assembly and disassembly of the pump, contact the local sales and service representative.

7 Troubleshooting

7.1 Troubleshooting for users

The main switch is on, but the electric pump does not start.

Cause	Remedy
The thermal protector incorporated in the pump (if any) has tripped.	Wait until the pump has cooled down. The thermal protector will automatically reset.
The protective device against dry running has tripped.	Check the liquid level in the tank, or the mains pressure.

The electric pump starts, but the thermal protection trips a varying time after.

Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the impeller.	Contact the Sales and Service Department.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and then contact the Sales and Service Department.

The pump runs but delivers too little or no liquid.

Cause	Remedy
The pump is clogged.	Contact the Sales and Service Department.

The troubleshooting instructions in the tables below are for installers only.

7.2 The main switch is on, but the electric pump does not start

Cause	Remedy
There is no power supply.	• Restore the power supply. • Make sure all electrical connections to the power supply are intact.
The thermal protector incorporated in the pump (if any) has tripped.	Wait until the pump has cooled down. The thermal protector will automatically reset.
The thermal relay or motor protector in the electric control panel has tripped.	Reset the thermal protection.
The protective device against dry running has tripped.	Check the: • liquid level in the tank, or the mains pressure • protective device and its connecting cables
The fuses for the pump or auxiliary circuits are blown.	Replace the fuses.

7.3 The electric pump starts, but the thermal protector trips or the fuses blow immediately after

Cause	Remedy
The power supply cable is damaged.	Check the cable and replace as necessary.
The thermal protection or fuses are not suited for the motor current.	Check the components and replace as necessary.
The electric motor is short circuit.	Check the components and replace as necessary.
The motor overloads.	Check the operating conditions of the pump and reset the protection.

7.4 The electric pump starts, but the thermal protector trips or the fuses blow a short time after

Cause	Remedy
The electrical panel is situated in an excessively heated area or is exposed to direct sunlight.	Protect the electrical panel from heat source and direct sunlight.
The power supply voltage is not within the working limits of the motor.	Check the operating conditions of the motor.
A power phase is missing.	Check the • power supply • electrical connection

7.5 The electric pump starts, but the thermal protector trips a varying time after

Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the impeller.	Contact the local sales and service representative.
The pumps delivery rate is higher than the limits specified on the data plate.	Partially close the on-off valve down stream until the delivery rate is equal or less than the limits specified on the data plate.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and replace the motor accordingly.
The motor bearings are worn.	Contact the local sales and service representative.

7.6 The electric pump starts, but the system's general protection is activated

Cause	Remedy
A short circuit in the electrical system.	Check the electrical system.

7.7 The electric pump starts, but the system's residual current device (RCD) is activated

Cause	Remedy
There is an ground (earth) leakage.	Check the insulation of the electrical system components.

7.8 The pump runs but delivers too little or no liquid

Cause	Remedy
There is air inside the pump or the piping.	• Bleed the air
The pump is not correctly primed.	Stop the pump and repeat the prime procedure. If the problem continues: • Check that the mechanical seal is not leaking. • Check the suction pipe for perfect tightness. • Replace any valves that are leaking.
The throttling on the delivery side is too extensive.	Open the valve.
Valves are locked in closed or partially closed position.	Disassemble and clean the valves.
The pump is clogged.	Contact the local sales and service representative.
The piping is clogged.	Check and clean the pipes.
The rotation direction of the impeller is wrong .	Change the position of two of the phases on the terminal board of the motor or in the electric control panel.
The suction lift is too high or the flow resistance in the suction pipes is too great.	Check the operating conditions of the pump. If necessary, do the following: • Decrease the suction lift • Increase the diameter of the suction pipe

7.9 The electric pump stops, and then rotates in the wrong direction

Cause	Remedy
There is a leakage in one or both of the following components: • The suction pipe • The foot valve or the check valve	Repair or replace the faulty component.
There is air in the suction pipe.	Bleed the air.

7.10 The pump starts up too frequently

Cause	Remedy
There is a leakage in one or both of the following components: • The suction pipe • The foot valve or the check valve	Repair or replace the faulty component.
There is a ruptured membrane or no air pre-charge in the pressure tank.	See the relevant instructions in the pressure tank manual.

7.11 The pump vibrates and generates too much noise

Cause	Remedy
Pump cavitation	Reduce the required flow rate by partially closing the on-off valve downstream from the pump. If the problem persists check the operating conditions of the pump (for example height difference, flow resistance, liquid temperature).
The motor bearings are worn.	Contact the local sales and service representative.
There are foreign objects inside the pump.	Contact the local sales and service representative.
Impeller rubs on the wear ring	Contact the local sales and service representative.

For any other situation, refer to the local sales and service representative.

LOWARA

Xylem Service Italia S.r.l.
Via Vittorio Lombardi 14
Montecchio Maggiore VI
36075
Italy
Contact your supplier or local sales and service representative

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F

FCSE inverter manual

This appendix reproduces the relevant mechanical installation details for the FCSE inverter.

5.1.2 Mechanical Dimensions

A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4
IP20/21	IP20/21	IP55/66	IP55/66	IP21/55/66	IP21/55/66	IP20	IP20	IP21/55/66	IP21/55/66	IP20	IP20
Accessory bags containing necessary brackets, screws and connectors are included with the adjustable frequency drives upon delivery.										Top and bottom mounting holes (B4, C3 and C4 only)	
* A5 in IP55/66 only											

Table 5.1 Mechanical Dimensions

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Enclosure Type			A2		A3		A4	A5	B1	B2	B3	B4	C1	C2	C3	C4
Rated Power (hp [kW])	**200–240 V**		**1.5–3 [1.1–2.2]**		**4–5 [3–3.7]**		**1.5–3 [1.1–2.2]**	**1.5–5 [1.1–3.7]**	**7.5–15 [5.5–11]**	**20 [15]**	**7.5–15 [5.5–11]**	**11–25 [15–18]**	**25–40 [18–30]**	**50–60 [37–45]**	**30–40 [22–30]**	**50–60 [37–45]**
	380–480/ 500 V		**1.5–5 [1.1–4.0]**		**7.5–10 [5.5–7.5]**		**1.5–5 [1.1–4]**	**1.5–10 [1.1–7.5]**	**15–25 [11–18]**	**30–40 [22–30]**	**15–25 [11–18]**	**30–50 [22–37]**	**50–75 [37–55]**	**100–125 [75–90]**	**60–75 [45–55]**	**100–125 [75–90]**
	525–600 V				**1.5–10 [1.1–7.5]**			**1.5–10 [1.1–7.5]**	**15–25 [11–18]**	**30–40 [22–30]**	**15–25 [11–18]**	**30–50 [22–37]**	**50–75 [37–55]**	**100–125 [75–90]**	**60–75 [45–55]**	**100–125 [75–90]**
	525–690 V									**15–40 [11–30]**				**50–125 [37–90]**		
IP NEMA			**20 Chassis**	**21 Type 1**	**20 Chassis**	**21 Type 1**	**55/66 Type 12**	**55/66 Type 12**	**21/ 55/66 Type 1/ Type 12**	**21/55/66 Type 1/ Type 12**	**20 Chassis**	**20 Chassis**	**21/55/66 Type 1/ Type 12**	**21/55/66 Type 1/ Type 12**	**20 Chassis**	**20 Chassis**
Height (in [mm])																
Height of backplate		A	10.60 [268]	14.76 [375]	10.6 [268]	14.76 [375]	15.35 [390]	16.54 [420]	18.90 [480]	25.59 [650]	15.71 [399]	20.47 [520]	26.77 [680]	30.32 [770]	21.65 [550]	25.98 [660]
Height with decoupling plate for serial communication bus cables		A	14.72 [374]		14.72 [374]	-	-	-	-	-	16.54 [420]	23.43 [595]			24.8 [630]	31.5 [800]
Distance between mounting holes		a	10.12 [257]	13.80 [350]	10.12 [257]	13.80 [350]	15.80 [401]	15.83 [402]	17.87 [454]	24.57 [624]	14.96 [380]	19.50 [495]	25.51 [648]	29.1 [739]	20.51 [521]	24.84 [631]
Width (in [mm])																
Width of backplate		B	3.54 [90]	3.54 [90]	5.12 [130]	5.12 [130]	7.87 [200]	9.53 [242]	9.53 [242]	9.53 [242]	6.5 [165]	9.06 [230]	12.13 [308]	14.57 [370]	12.13 [308]	14.57 [370]
Width of backplate with one C option		B	5.12 [130]	5.12 [130]	6.69 [170]	6.69 [170]		9.53 [242]	9.53 [242]	9.53 [242]	8.07 [205]	9.06 [230]	12.13 [308]	14.57 [370]	12.13 [308]	14.57 [370]
Width of backplate with two C options		B	5.91 [150]	5.91 [150]	7.48 [190]	7.48 [190]		9.53 [242]	9.53 [242]	9.53 [242]	8.86 [225]	9.06 [230]	12.13 [308]	14.57 [370]	12.13 [308]	14.57 [370]
Distance between mounting holes		b	2.76 [70]	2.76 [70]	4.33 [110]	4.33 [110]	6.73 [171]	8.47 [215]	8.27 [210]	8.27 [210]	5.51 [140]	7.87 [200]	10.71 [272]	13.15 [334]	10.63 [270]	13 [330]
Depth (in [mm])																
Depth without option A/B		C	8.07 [205]	18.15 [207]	8.07 [205]	18.15 [207]	6.89 [175]	7.87 [200]	10.24 [260]	10.24 [260]	9.8 [249]	9.53 [242]	12.21 [310]	13.19 [335]	12.99 [333]	12.99 [333]
With option A/B		C	8.66 [220]	8.74 [222]	8.66 [220]	8.74 [222]	6.89 [175]	7.87 [200]	10.24 [260]	10.24 [260]	10.32 [262]	9.53 [242]	12.21 [310]	13.19 [335]	12.99 [333]	12.99 [333]

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Enclosure Type			A2		A3		A4	A5	B1	B2	B3	B4	C1	C2	C3	C4
Rated Power (hp [kW])	200–240 V		1.5–3 [1.1–2.2]		4–5 [3–3.7]		1.5–3 [1.1–2.2]	1.5–5 [1.1–3.7]	7.5–15 [5.5–11]	20 [15]	7.5–15 [5.5–11]	11–25 [15–18]	25–40 [18–30]	50–60 [37–45]	30–40 [22–30]	50–60 [37–45]
	380–480/ 500 V		1.5–5 [1.1–4.0]		7.5–10 [5.5–7.5]		1.5–5 [1.1–4]	1.5–10 [1.1–7.5]	15–25 [11–18]	30–40 [22–30]	15–25 [11–18]	30–50 [22–37]	50–75 [37–55]	100–125 [75–90]	60–75 [45–55]	100–125 [75–90]
	525–600 V				1.5–10 [1.1–7.5]			1.5–10 [1.1–7.5]	15–25 [11–18]	30–40 [22–30]	15–25 [11–18]	30–50 [22–37]	50–75 [37–55]	100–125 [75–90]	60–75 [45–55]	100–125 [75–90]
	525–690 V									15–40 [11–30]				50–125 [37–90]		
IP NEMA			20 Chassis	21 Type 1	20 Chassis	21 Type 1	55/66 Type 12	55/66 Type 12	21/ 55/66 Type 1/ Type 12	21/55/66 Type 1/ Type 12	20 Chassis	20 Chassis	21/55/66 Type 1/ Type 12	21/55/66 Type 1/ Type 12	20 Chassis	20 Chassis
Screw holes (in [mm])																
		c	0.32 [8.0]	0.32 [8.0]	0.32 [8.0]	0.32 8.0]	0.33 [8.25]	0.33 [8.25]	0.47 [12]	0.47 [12]	8		0.49 [12.5]	0.49 [12.5]		
		d	ø0.43 [ø11]	ø0.43 [ø11]	ø0.43 [ø11]	ø0.43 [ø11]	ø0.47 [ø12]	ø0.47 [ø12]	ø0.75 [ø19]	ø0.75 [ø19]	0.47 [12]		ø0.75 [ø19]	ø0.75 [ø19]		
		e	ø0.22 [ø5.5]	ø0.22 [ø5.5]	ø0.22 [ø5.5]	ø0.22 [ø5.5]	ø0.26 [ø6.5]	ø0.26 [ø6.5]	ø0.35 [ø9]	ø0.35 [ø9]	0.27 [6.8]	0.34 [8.5]	ø0.35 [ø9]	ø0.35 [ø9]	0.34 [8.5]	0.34 [8.5]
		f	0.35 [9]	0.35 [9]	0.26 [6.5]	0.26 [6.5]	0.24 [6]	0.35 [9]	0.35 [9]	0.35 [9]	0.31 [7.9]	0.59 [15]	0.39 [9.8]	0.39 [9.8]	0.67 [17]	0.67 [17]
Max weight lbs [kg]			10.8 [4.9]	11.68 [5.3]	14.6 [6.6]	15.5 [7.0]	21.5 [9.7]	30/31.5 [13.5/14.2]	50.7 [23]	59.53 [27]	26.5 [12]	52 [23.5]	99.21 [45]	143.3 [65]	77.2 [35]	110.2 [50]
Front cover tightening torque [Nm]																
Plastic cover (low IP)			Click		Click		-	-	Click	Click	Click	Click	Click	Click	2.0	2.0
Metal cover (IP55/66)			-		-		1.5	1.5	2.2	2.2	-	-	2.2	2.2	2.0	2.0

Table 5.2 Weight and Dimensions

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Datasheets

This appendix reproduces datasheets for the various components used within the system.

ENGINEERING
TOMORROW

Fact Sheet

VLT® HVAC Drive FC 102

The VLT® HVAC Drive series is available in a wide power range designed for all HVAC applications. An advanced drive built on HVAC dedication.

The VLT® HVAC Drive is a full-featured, HVAC dedicated drive with built-in intelligence. The VLT® HVAC Drive has a vast number of functions developed to meet the diverse needs of the HVAC business. It is the perfect match for pumps, fans and compressors in modern buildings that are fitted with increasingly sophisticated solutions.

NABERS compliance

Thanks to its built-in energy meter, the VLT® HVAC Drive is certified as fully compliant with National Australian Built Environment Rating System (NABERS) requirements. This means you save on installation time and cost, because there is no need to install a separate energy meter.

98%
energy efficiency

Save energy and money with up to 98% efficiency VLT® drives.

Product range

3 x 200 – 240 V.....1.1 – 45 kW
3 x 380 – 480 V.....1.1 – 1000 kW
3 x 525 – 600 V.....1.1 – 90 kW
3 x 525 – 690 V.....1.1 – 1400 kW
With 110% overload torque

Available protection ratings

IP 00 .....355 – 630 kW
IP 20.....1.1 – 400 kW
IP 21 (Type 1) .....1.1 – 1400 kW
IP 54 (Type 12) .....75 – 1400 kW
IP 55 (Type 12) .....1.1 – 90 kW
Type 3R.....1.1 – 400 kW
IP 66 (Type 4X indoor) .....1.1 – 90 kW
Optional coating providing extra protection for aggressive environments.

Feature	Benefit
All built-in – low investment	
Modular product concept with a wide range of options	Low initial investment – max. flexibility, later upgrade possible
Dedicated HVAC I/O functionality for temperature sensors etc.	External conversion saved
Decentral I/O control via serial communication	Reduced wiring costs, and external controller I/O saved
Wide range of HVAC protocols for BMS controller connectivity	Less extra gateway solutions needed
4 x auto tuned PID's	No external PID controller needed
Smart Logic Controller	Often makes PLC unnecessary
Real Time Clock	Enables daily and weekly settings
Integrated fan, pump and compressor functionality i.e.	Saves external control and conversion equipment
Fire Override Mode, Dry run Detection, Constant Torque etc.	Protects equipment and saves energy
Back-channel cooling for frame D, E and F frame	Prolonged lifetime of electronics
Save energy – less operation cost	
Automatic Energy Optimizer function, advanced version	Saves 5 – 15% energy
Advanced energy monitoring	Overview on energy consumption
Energy saving functions i.e. flow compensation, sleep mode etc.	Saves energy
Unequalled robustness – maximum uptime	
Robust single enclosure	Maintenance-free
Unique cooling concept with no ambient air flow over electronics	Problem-free operation in harsh environments
Max ambient temp. 50°C without derating (D-frame 45°C)	No external cooling or oversize necessary
User-friendly – save commissioning and operating cost	
Smart Start	Quick and precise start-up
Awarded graphical display, 27 languages	Effective commissioning and operation
USB plug and play connection	Easy to use PC software tools
Global HVAC support organisation	Local service – globally
Built-in DC coils and RFI filters – no EMC concerns	
Integrated DC link harmonic filters	Small power cables. Meets EN 61000-3-12
IntegratedEMC filters	Meets EN 55011 Class B, A1 or A2 and IEC61800-3 Category C1, C2 and C3

ENGINEERING
TOMORROW

Application options

A wide range of integrated HVAC options can be fitted in the drive:

VLT® General Purpose I/O MCB 101
3 digital inputs, 2 digital outputs, 1 analog current output, 2 analog voltage inputs.

VLT® Relay Card MCB 105
Adds 3 relay outputs.

VLT® Extended Relay Card MCB 113
7 digital inputs, 2 analog outputs 4 SPDT relays, Meets NAMUR recommendations, Galvanic isolation capability

VLT® Analog I/O MCB 109
3 Pt1000/Ni1000 inputs, 3 analogue voltage outputs and back-up power for Real-Time Clock.

VLT® 24 V External Supply MCB 107
24 VDC external supply can be connected to supply, control and option cards.

VLT® Sensor Input MCB 114
Sensor input card for motor protection with 2 or 3 PT100 or PT1000 inputs

Brake chopper (IGBT) option
Connected to an external brake resistor, the built-in brake chopper limits the load on the intermediate circuit in situations where the motor acts as a generator.

VLT® BACnet/IP MCA 125
Use this option for fast access to information and reduced overall cost of ownership in building management systems. It enables communication via the BACnet/IP protocol, and BACnet over Ethernet.

Power options

A wide range of external power options are available for VLT® HVAC Drives in critical networks or applications:

- **VLT® Advanced Harmonic Filter**
  For critical demands on harmonic distortion

Specifications

Mains supply (L1, L2, L3)	
Supply voltage	200 – 240 V ±10% 380 – 480 V ±10% 525 – 600 V ±10% 525 – 690 V ±10%
Supply frequency	50/60 Hz
Displacement power factor (cos φ)	> 0.98 near unity
Switching on input supply L1, L2, L3	1–2 times/min.
Output data (U, V, W)	
Output voltage	0 – 100% of supply voltage
Switching on output	Unlimited
Ramp times	1–3600 s
Output frequency	0–590 Hz
Digital inputs	
Programmable digital inputs	6*
Logic	PNP or NPN
Voltage level	0 – 24 VDC

** 2 can be used as digital outputs*

Pulse inputs	
Programmable pulse inputs	2*
Voltage level	0–24 VDC (PNP positive logic)
Pulse input accuracy	(0.1–110 kHz)

** Utilize some of the digital inputs*

Analog input	
Analog inputs	2
Modes	Voltage or current
Voltage level	0 V to +10 V (scaleable)
Current level	0/4 to 20 mA (scaleable)
Analog output	
Programmable analog outputs	1
Current range at analog output	0/4 – 20 mA
Relay outputs	
Programmable relay outputs	2 (240 VAC, 2 A and 400 VAC, 2 A)
Fieldbus communication	
Standard built-in: FC Protocol N2 Metasys FLN Apogee Modbus RTU BACnet embedded	Optional: VLT® LonWorks MCA 108 VLT® BACnet MCA 109 VLT® BACnet/IP MCA 125 VLT® DeviceNet MCA 104 VLT® PROFIBUS DP MCA 101

- **VLT® dU/dt Filter**
  For special demands on motor isolation protection
- **VLT® Sine Wave Filter**

HVAC PC software tools

- **VLT® Motion Control Tool MCT 10**
  Ideal for commissioning and servicing the drive
- **VLT® Energy Box**
  Comprehensive energy analysis tool. Energy consumption with and without drive can be calculated (drive payback time). Online function for accessing drives energy log.
- **VLT® Motion Control Tool MCT 31**
  Harmonics calculation tool

High power options

- IEC Emergency stop with Safety Relay
- Safety Stop with Safety Relay
- RFI filter
- NAMUR terminals
- RCD
- IRM
- Mains shielding
- Regen terminals

Please see the VLT® High Power Drive Selection Guide for the complete range of options.

Danfoss Drives, Ulsnaes 1, DK-6300 Graasten, Denmark, Tel. +45 74 88 22 22, Fax +45 74 65 25 80, drives.danfoss.com, E-mail: info@danfoss.com

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100mm Diameter Glycerine Filled Pressure Gauge

Application

For the measurement of fluid liquids that are not:- highly viscous, high temperature (over 60°C), likely to solidify/crystallize or corrosive to copper or tin alloys.

Also suitable for non-oxidising gases (such as oxygen or acetylene) up to 25 bar maximum.

Glycerine filled gauges are particularly suited to applications where oscillating/surging pressures or vibration are present. The damping effect of the glycerine will steady the pointer making it easier to take a reading against the scale.

Description

Nominal Size
100mm

Accuracy
+/- 1.6% FSD

Scales
PSI Outer (Black) & BAR Inner (Red) - Pressure
"HG Outer (Black) & BAR Inner (Red) - Vacuum
"HG+PSI Outer (Black) & BAR Inner (Red) - Compound

Ranges
-30/0"HG Vacuum to 0/10000 PSI Pressure
-30"HG/+15 PSI to -30"HG/+160 PSI Compound

Mounting Options
Bottom - Direct Mounting (standard)
Bottom - Surface Mounting Rear 3 Hole Flange

Centre Back - Direct Mounting (standard)
Centre Back - Panel Mounting Rear Bracket
Centre Back - Panel Mounting Front 3 Hole Flange

Operating Temperature
Ambient: -20/+60°C
Medium: +60°C maximum

Temperature Effect
Variation in indication caused by temperature
± 0.04 x (t2 – t1)% of the span
t1 is the reference ambient temperature in °C
t2 is the ambient temperature in °C

Ingress Protection
IP 65 as per EN 60529

Case & Crimped Bezel
304 Stainless Steel

Window
Polycarbonate - Crystal clear

Pressure Element
CU Alloy - Sealed Bourdon tube
C-Type <100 BAR
Coiled Type >100 BAR

Joints
Soldered with tin/silver alloy

Movement
High Precision Brass

Process Connection & Block
Brass - 3/8" BSP (parallel) male (standard)
Brass - 1/2" BSP (parallel) male (standard)
Brass - 22mm Hexagon block

Pointer
Aluminium - Black

Dial
Aluminium - White

Filling
FDA Approved food grade glycerine

Special Options
Other scales/ranges
Customer logo on dial
Other process connections
Rubber gauge cover

Sondex UK PHE - Design & Datalist

Att : Mike West — Item :1 V10A34

QuotationNo : 754 — Ref : 168 — 23 March 2015

PHE-Type	S47-IG10-146-TMTL86-LIQUII	Hot side	Cold side
Flowrate	(kg/s)	23.88	23.88
Inlet temperature	(°C)	24.00	18.00
Outlet temperature	(°C)	19.00	23.00
Pressure drop	(kPa)	50.78	50.77
Heat exchanged	(kW)	500	
Thermodynamic properties:		**Water**	**Water**
Density	(kg/m³)	997.38	997.60
Specific heat	(kJ/kg*K)	4.19	4.19
Thermal conductivity	(W/m*K)	0.60	0.60
Mean viscosity	(mPa*s)	0.97	0.99
Wall viscosity	(mPa*s)	0.99	0.97
Fouling factors	(m²*K/kW)		
Dimensioning factor	(%)		
Inlet branch		F1	F3
Outlet branch		F4	F2

Design of Frame / Plates:		
Plate arrangement (passes*channel)		1 × 73 + 0 × 0
Plate arrangement (passes*channel)		1 × 72 + 0 × 0
Number of plates		146
Effective heat surface	(m²)	74.04
Overall K-value Duty/Clean	(W/m²*K)	6754 / 6754
Plate material		0.4 mm AISI 304
Gasket material / Max. temp.	(°C)	NITRIL HT SONDER LOCK (S) / 140
Max. design temperature	(°C)	100.00
Max. Working/test pressure	(MPa)	1,00 / ACC. to PED 97/23/EC Art 3.3
Max. Differential pressure	(MPa)	1.00
Frame type / Paint Specification		IG No 4 / Category C2L BLUE RAL 5010
Connections HOT side	(F1->F4)	DN 100 Flange rubberlined PN16 HT
Connections COLD side	(F3->F2)	DN 100 Flange rubberlined PN16 HT
Liquid volume	(dm³)	167
Frame length	(mm)	1034 Max. No. of Plates 155
Net weight	(kg)	716

PRICE EACH	**GBP**	3623	**Approval**
TERMS OF DELIVERY			Ex works Freight and Packing extra @ GBP
TERMS OF PAYMENT			30 Days
DELIVERY TIME			
VALIDITY OF QUOTATION			30 Days
DESIGNED BY			Peter Cole

Skid Base (2000x800)		92
Accesories:	**GBP**	92

Sondex UK LTD **Swallowfield Way** **Hayes, UB3 1AW**

Tlf : +44 208 573 6276 **Fax : +45 75538968/75505019**

Rosemount 2110 Compact Vibrating Fork Liquid Level Switch

- *Function virtually unaffected by flow, turbulence, bubbles, foam, vibration, solids content, coating, properties of the liquid, and product variations*
- *No need for calibration and requires minimum installation procedures*
- *Polarity insensitive and short circuit protection*
- *Industry standard plug/socket connection*
- *No moving parts or crevices means virtually no maintenance*
- *Electronic, self-checking, and condition monitoring - Heartbeat LED gives status and health information*
- *Magnetic test point makes functional test easy*
- *Compact design, small in size and weight*
- *"Fast Drip" Fork Design gives quicker response time especially with viscous liquids*
- *Hygienic connections*

DIBt

Contents

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Reliable Performance...In Challenging Applications

Threaded Process Connection

Tri-Clamp Process Connection

Compact And Lightweight

'Fast Drip' Forks

MEASUREMENT PRINCIPLE

The Rosemount 2110 is designed using the principle of a tuning fork. A piezo-electric crystal oscillates the forks at their natural frequency. Changes to this frequency are continuously monitored. The frequency of the vibrating fork sensor changes depending on the medium in which it is immersed. The denser the liquid, the lower the frequency.

When used as a **low level alarm**, the liquid in the tank or pipe drains down past the fork, causing a change of natural frequency that is detected by the electronics and switches the output state.

When the 2110 is used as a **high level alarm**, the liquid rises in the tank or pipe, making contact with the fork which then causes the output state to switch.

KEY FEATURES AND BENEFITS

- Virtually unaffected by turbulence, foam, vibration, solids content, coating, or liquid properties
- Stainless steel housing and plug/socket connection for the fast fit, high volume user
- Compact and lightweight design for side or top mounting
- The industry standard DIN 43650 plug/socket is used for a fast connection. The polarity insensitivity and short circuit protection make electrical hook-up safe and easy
- The 2110 is designed for operation in temperatures from –40 to 302 °F (–40 to 150 °C)
- The 'heartbeat' LED gives status and health information on the 2110
- 'Fast Drip' fork design gives quicker response time, especially with viscous liquids
- Rapid wet-to-dry time for highly responsive switching
- Fork shape is optimized for hand polishing to meet hygienic requirements
- No moving parts or crevices for virtually no maintenance

Fit and Forget

- Once installed, the 2110 is ready to go.
  It needs no calibration and requires minimum installation
- The ‘heartbeat’ LED gives an instant visual indication that the unit is operational
- Functional testing of the instrument and system is easy with a magnetic test point
- You can install, and forget it

Superior Performance

- Functionality is virtually unaffected by flow, turbulence, bubbles, foam, or vibration
- The ‘Fast Drip’ design allows the liquid to be quickly drawn away from the fork tip, making the 2110 quicker and more responsive in high density or viscous liquid applications
- With a user-selectable time delay feature, the risk of false switching is minimized in turbulent or splashing applications

APPLICATIONS

- Overfill protection
- High and low level alarms
- Leak detection
- Run dry or pump protection
- Pump control or limit detection
- Hygienic applications

Overfill Protection

High And Low Level Alarm

Leak Detection

Pump Protection

Rosemount 2110
Compact Vibrating Fork Liquid Level Switch

2110 Level Switch

Rosemount 2110 capabilities include:

- Rugged stainless steel body and fork, the ideal choice for OEM applications
- Compact design, small and lightweight, perfect for small tank or pipe installations
- Short fork or semi-extended lengths
- Direct load switching or PNP/PLC electronics
- Safe area only

Additional Information

Specifications: page 5
Certifications: page 6
Dimensions: page 7

TABLE 1. 2110 Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	Product Description	
2110	Compact Vibrating Fork Liquid Level Switch	
Electronic Type		
Standard		**Standard**
0	Direct load switching with plug connection (2 wire) 21 to 264 Vac 50/60Hz, 21 to 264 Vdc	★
1	PNP/PLC low voltage switching with plug connection 18 to 60 Vdc	★
Process Connection Size / Type		
Standard		**Standard**
0A	3/4-in. BSPT (R) thread	★
1A	1-in. BSPT (R) thread	★
0D	3/4-in. NPT thread	★
2R	2-in. (51 mm) Tri-clamp	★
1B	1-in. BSPP (G) thread	★
1L	1-in. BSPP (G) Semi-extended 4.6 in. (116 mm)	★
Product Certificates		
Standard		**Standard**
NA	No hazardous locations certifications (safe area use only)	★
U1	DIBt/WHG Overfill protection	★
OPTIONS		
Calibration Data Certificate		
Standard		**Standard**
Q4	Certificate of functional test	★
Tag Plate		
Standard		**Standard**
ST	Tag plate SST engraved plate (maximum 16 digits)	★
WT	Tag plate laminated paper (maximum 40 digits)	★
Typical Model Number: 2110 0 2R NA		

TABLE 2. Spare Parts and Accessories

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Spares and Accessories		
Standard		**Standard**
02100-1000-0001	Seal for 1-in. BSPP (G1A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder	★
02100-1010-0001	Hygienic adaptor boss for 1-in. BSPP model. Material: 316 SST fitting. Fluorocarbon (FPM/FKM) O-ring	★
02100-1020-0001	Hygienic mounting kit for 2-in. (51 mm) Tri-clamp model. Includes vessel fitting, clamp ring, and seal. Material: 316 SST and NBR Nitrile	★
02100-1030-0001	Telescopic test magnet	★

Specifications

PHYSICAL

Product
Rosemount 2110 Compact Liquid Level Switch

Measuring principle
Vibrating Fork

Applications
Most liquids including coating liquids, aerated liquids, and slurries

Mechanical

Process Material
316L Stainless Steel (1.4404)

For Tri-Clamp connection, hand polished to better than 0.8 µm. Gasket material for 1 in. BSPP (G1) is Non-asbestos BS7531 Grade X carbon fiber with rubber binder.

Housing Materials
Body: 304 SST with polyester label
LED window:
Flame retardant Polyamide (Pa12) UL94 V2
Plug: Polyamide glass reinforced
Plug seals: Nitrile butadiene rubber

Mounting
- 3/4-in. BSPT (R) or NPT
- 1-in. BSPT (R) or BSPP (G) thread, or
- Hygienic 2-in. (51 mm) Tri-clamp fitting

Dimensional Drawings
See “Dimensional Drawing” on page 7

Ingress of Protection Rating
IP66/67 to EN60529

PERFORMANCE

Hysteresis (water)
±0.039-in. (± 1 mm) nominal.

Switching Point (water)
0.5 in. (13 mm) from fork tip if mounted vertically.

0.5 in. (13 mm) from the fork edge if mounted horizontally.

The switch point varies with different liquid densities.

FUNCTIONAL

Maximum Operating Pressure
(The final rating depends on the process connection)

Threaded Connection
See Figure 1

Hygienic Connection
435 psig (30 barg)

Figure 1. Process Pressure

Temperature
See Figure 2 for the maximum and minimum operating temperatures.

Figure 2. Temperature

Liquid Density
Minimum 37.5 lb/ft^3 (600 kg/m^3)

Liquid Viscosity Range
0.2 to 10000 cP (centiPoise)

Solids Content and Coating
Maximum recommended diameter of solid particles in the liquid is 0.2 in. (5 mm).
For coating product, avoid ‘bridging’ of forks.

Switching Delay
1 second dry-to-wet or wet-to-dry

CIP (Clean In Place) Cleaning
Withstands steam cleaning routines up to 302 °F (150 °C)

Electrical

Switching Mode
User selectable (Dry=on or Wet=on) by selecting plug wiring

Cable Connection
Via 4-way plug provided (DIN43650).
Max. conductor size is 15AWG.
4-position orientation (90/180/270/360 deg).

Conductor Size
Maximum 0.06 in.^{2} (1,5 mm^2)

Cable Gland
PG9 provided. Cable diameter 0.24 to 0.31 in. (6 to 8 mm)

Protection
Polarity insensitive. Over-current, short circuit, and load-missing protection. Surge protection to IEC61326.

Grounding
The 2110 should always be grounded either through the terminals or using the external ground connection provided.

Direct Load Switching (Electronics Type Code 0)	
Operating Voltage	21 to 264 Vac (50 to 60 Hz)/dc
Maximum switched load	500 mA
Maximum peak load	5 A for 40 ms max.
Minimum switched load	20 mA continuous
Voltage drop	6.5 V @ 24 Vdc / 5 V @ 240 Vac
Current draw (load off)	<3.0 mA continuous

PNP Switching (Electronics Type Code 1)	
Operating Voltage	18 to 60 Vdc
Maximum switched load	500 mA
Maximum peak load	5 A for 40 ms max.
Voltage drop	<3 V
Supply Current	3 mA nominal
Output current (load off)	<0.5 mA

Product Certifications

L.V. Directive
EN61010-1 Pollution degree 2,
Category II (264V max),
Pollution degree 2, Category III (150 V maximum)

Electro Magnetic Compatibility (EMC) Directive
EN61326

Overfill Protection
If required, select Product Certificates code U1 for DIBt/WHG overfill protection.
The approval number is Z-65.11-236.

Canadian Registration Number (CRN)
The CRN is 0F04227.2C for model numbers with a NPT threaded process connection selected.

Dimensional Drawing

Process Connections	A	B	C	D
3/4-in. BSPT (R)	2.72 (69)	1.97 (50)	7.40 (188)	N/A
3/4-in. NPT	2.72 (69)	1.97 (50)	7.40 (188)	N/A
1-in. BSPT (R)	2.72 (69)	1.97 (50)	7.40 (188)	N/A
1-in. BSPP (G)	3.07 (78)	2.36 (60)	7.91 (201)	N/A
2-in. (51 mm) Tri-Clamp	2.72 (69)	1.97 (50)	7.40 (188)	2.52 (64)
1-in. Semi-extended	4.57 (116)	3.86 (98)	9.41 (239)	N/A

Rosemount Level Solutions

Emerson provides a complete range of Rosemount products for level measurement applications.

Vibrating Fork Switches – Point Level Detection

For high and low alarms, overfill protection, pump control, including wide pressure and temperature requirements, and hygienic applications. Flexible mounting. Immune to changing process conditions and suitable for most liquids.
The product line consists of:

- Rosemount 2160 Wireless
- Rosemount 2130 Enhanced
- Rosemount 2120 Full-featured
- Rosemount 2110 Compact

Differential Pressure – Level or Interface Measurement

Flexible mounting for liquid tank levels, including those with wide temperature and pressure requirements. Can be isolated by valves. Unaffected by: vapor space changes, surface conditions, foam, corrosive fluids, internal tank equipment. Optimize performance with direct mount, Tuned-System Assemblies:

- Rosemount DP Level Transmitters and Remote Seals
- Rosemount 3051S_L, 3051L, and 2051L Liquid Level Transmitters

Ultrasonic – Level Measurement

Top mounted, non-contacting for simple tank and open air level measurements. Unaffected by fluid properties such as: density, viscosity, dirty coating, and corrosiveness. Appropriate for routine applications outside of explosion proof areas.
The product line consists of:

- Rosemount 3100 Series Ultrasonic Process Level Transmitters

Guided Wave Radar – Level and Interface Measurement

Top mounted, direct level and interface measurement of liquids or solids, including those with wide temperature and pressure requirements. Unaffected by changing process conditions. Good fit for small spaces and easy swap for older technologies.
The product line consists of:

- Rosemount 5300 Series – Accurate, superior performance transmitter in most applications including process vessels and control
- Rosemount 3300 Series – Versatile and easy-to-use transmitter in most liquid storage and monitoring applications

Non-contacting Radar – Level Measurement

Top mounted, direct level measurement for liquids or solids, including those with wide temperature and pressure requirements. Can be isolated by valves. Unaffected by changing process conditions. Good for dirty, coating, and corrosive applications.
The product line consists of:

- Rosemount 5400 Series – Accurate, superior performance 2-wire transmitters for most liquid level applications and process conditions
- Rosemount 5600 Series – 4-wire transmitters with maximum sensitivity and performance for solids, challenging reactors, rapid level changes, and excessive process conditions

Chambers for Process Level Instrumentation

- Rosemount 9901 – High quality chambers for external mounting of level measurement and control instrumentation on process vessels

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Emerson Process Management
Rosemount Measurement
8200 Market Boulevard
Chanhassen, MN 55317 USA
Tel (USA) 1 800 999 9307
Tel (International) +1 952 906 8888
Fax +1 952 949 7001
www.rosemount.com

Emerson Process Management
Blegistrasse 23
P.O. Box 1046
CH 6341 Baar
Switzerland
Tel +41 (0) 41 768 6111
Fax +41 (0) 41 768 6300

Emerson FZE
P.O. Box 17033
Jebel Ali Free Zone
Dubai UAE
Tel +971 4 811 8100
Fax +971 4 886 5465

Emerson Process Management
Asia Pacific Pte Ltd
1 Pandan Crescent
Singapore 128461
Tel +65 6777 8211
Fax +65 6777 0947
Service Support Hotline: +65 6770 8711
Email: Enquiries@AP.EmersonProcess.com

EMERSON
Process Management

pCO5+ Controllo elettronico programmabile / Electronic programmable control

CAREL

pGDE*

LEGGI E CONSERVA QUESTE ISTRUZIONI
READ AND SAVE THESE INSTRUCTIONS

NO POWER & SIGNAL CABLES TOGETHER

READ CAREFULLY IN THE TEXT!

ITA DESCRIZIONE

pCO5+ è un controllo elettronico programmabile a microprocessore sviluppato da CAREL per offrire molteplici applicazioni nel settore del condizionamento dell'aria, della refrigerazione e in generale del settore HVAC/R. Può essere collegato in rete pLAN a tutti i controlli della famiglia pCO sistema ed ai terminali della gamma pGD. Il programma applicativo, creato nell'ambiente di sviluppo 1Tool, è caricato sul controllo tramite il programma pCO Manager, disponibile sul sito http://ksa.carel.com. Vedere il man. cod. +0300020IT, scaricabile dal sito www.carel.com.

ENG *DESCRIPTION*

pCO5+ is a programmable microprocessor electronic controller developed by CAREL to offer numerous applications in the air conditioning and refrigeration industry and in the general HVAC/R sector. It can be connected over the pLAN to all controllers in the pCO system family and to terminals in the pGD line. The application, created in the 1Tool development environment, is loaded on the controllers through the pCOManager program, available at http://ksa.carel.com. See manual code +0300020EN, that can be downloaded from www.carel.com.

ITA DIMENSIONI (mm)

ENG *DIMENSIONS (mm)*

	Small	Medium	Buit-in driver	Large	Extralarge
A	227,5	315	315	315	315
B	60	60	60	60	60
B - con porta USB e/o terminale integrato *B - with USB port and/or built-in terminal*	70	70	70	70	70
B - con modulo ULTRACAP *B - with ULTRACAP module*	-	-	75	-	-

ITA MODELLI (vedere listino per codici di acquisto ordinabili)

Codice	Descrizione	Classific.
P+5**********	Memoria 9MB (7MB programma applicativo +2MB Bios)+4MB storici	Memoria
P+3**********	Memoria 5MB (3MB programma applicativo +2MB Bios) +2MB storici (◆)	Memoria
P+5*****0****	Uscite digitali tutte a relè	Tipo di uscita digitale
P+5*****1...6****	1...6 uscite SSR a 24 V	Tipo di uscita digitale
P+5*****A...F****	1...6 uscite SSR a 230 V	Tipo di uscita digitale
P+5****0*****	Standard	Connettività
P+5****A*****	BMS2 non optois. - FieldBus2 non optois.	Connettività
P+5****B*****	BMS2 optois. / FieldBus2 non optoisolata	Connettività
P+5****C*****	BMS2 optoisolata / FieldBus2 optoisolata	Connettività
P+5***0******	No porta USB	Porta USB
P+5***A******	Porta USB	Porta USB
P+5******0***	Senza driver valvola	Driver valvola
P+5******1***	1 driver valvola CAREL	Driver valvola
P+5******2***	2 driver valvola CAREL	Driver valvola
P+5*******0**	Senza terminale	Terminale integrato
P+5*******E**	Con terminale	Terminale integrato
P+5********S*	Small	Taglia
P+5********M*	Medium	Taglia
P+5********L*	Large	Taglia
P+5********Z*	Extralarge	Taglia
P+5*********0/1	Singolo - multiplo	Imballo

(◆)I modelli previsti sono P+3**B00*0(0,E)(S,M,L,Z)0

Codice	Descrizione
PGDE000*	Terminale utente PGDE
PGDT04000F***	Termin. utente pGD Touch 4,3"
PGDT0700F***	Term. utente pGD Touch 7"
PCO5OWUC20	Modulo ultracap per pCO5+ built-in driver
S90CONN00*	Cavo telefonico

WARNING: separate as much as possible the probe and digital input signal cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance. Never run power cables (including the electrical panel wiring) and signal cables in the same conduits.

Disposal of the product: the appliance (or the product) must be disposed of separately in accordance with the local waste disposal legislation in force.

ENG *MODELS (see the list price for purchase codes, that can be ordered)*

Code	*Description*	*Classific.*
*P+5**********	*9MB (7MB application program +2MB Bios) +4MB memory log file*	*Memory*
*P+3**********	*5MB (3MB application program +2MB Bios) +2MB memory log file (◆)*	*Memory*
*P+5*****0****	*Digital outputs all relay*	*Digital output type*
*P+5*****1...6****	*1 to 6 SSR outputs, 24V*	*Digital output type*
*P+5*****A...F****	*1 to 6 SSR outputs, 230V*	*Digital output type*
*P+5****0*****	*Standard*	*Connectivity*
*P+5****A*****	*BMS2 not optois. - FieldBus2 not optois.*	*Connectivity*
*P+5****B*****	*BMS2 optois. / FieldBus2 not optoisolated*	*Connectivity*
*P+5****C*****	*BMS2 optoisolated / FieldBus2 optoisolated*	*Connectivity*
*P+5***0******	*No USB port*	*USB Port*
*P+5***A******	*USB port*	*USB Port*
*P+5******0***	*without valve driver*	*Driver valve*
*P+5******1***	*1 CAREL driver valve*	*Driver valve*
*P+5******2***	*2 CAREL driver valve*	*Driver valve*
*P+5*******0**	*Without terminal*	*Integrated terminal*
*P+5*******E**	*With terminal*	*Integrated terminal*
*P+5********S**	*Small*	*Size*
*P+5********M**	*Medium*	*Size*
*P+5********L**	*Large*	*Size*
*P+5********Z**	*Extralarge*	*Size*
*P+5*********0/1*	*Single - multiple*	*Packaging*

*(◆)The models provided are P+3**B00*0(0,E)(S,M,L,Z)0.*

Code	*Description*
*PGDE000**	*User terminal PGDE*
*PGDT04000F****	*User terminal pGD Touch 4.3"*
*PGDT0700F****	*User terminal pGD Touch 7"*
PCO5OWUC20	*Ultracap module for pCO5+ built-in driver*
*S90CONN00**	*Telephone cable*

ITA

Caratteristiche tecniche

Contenitore plastico

Montaggio	agganciabile su guida DIN secondo DIN 43880 CEI EN 50022
Materiale	tecnopolimero
Autoestinguenza	V2 (secondo UL94) e 850 °C (secondo IEC 60695)
Temperatura per la prova con la sfera	125 °C
Resistenza alle correnti striscianti	≥ 250 V
Colore	Bianco RAL 9016
Terminale integrato	Tipo PGD1 (132x64 pixel) con tastiera retroilluminata

Altre caratteristiche

Condizioni di funzionamento	P+(3,5)*******0**(no terminale integrato): -40T70 °C, 90% UR non conden. (*)
(**) con modulo Ultracap montato: -40T60°C	P+(3,5)*******E**(con terminale integrato): -20T60 °C, 90% UR non conden. (*)
Condizioni di immagazzinamento	P+(3, 5)*******0**(no terminale integrato): -40T70 °C, 90% UR non condens.
	P+(3, 5)*******E**(con terminale integr.): -30T70 °C, 90% UR non condens.
Grado di protezione	Mod. con porta USB e/o con modulo Ultracap: IP20 nel solo frontalino
	Mod. senza porta USB e senza modulo Ultracap: IP40 nel solo frontalino
Situaz. di inquinam. del dispos. di comando	2
Classe secondo la protezione contro le scosse elettriche	da integrare su apparecchiature di Classe I e/o II nelle versioni senza driver valvola, classe I nelle versioni con driver valvola
PTI dei materiali per isolamento	PCB: PTI 250 V; materiale di isolamento: PTI 175
Periodo delle sollec. elettr. delle parti isolanti	lungo
Tipo azioni	1C; 1Y per le versioni a SSR
Tipo di disconnessione o microinterruzione	microinterruzione
Categoria di resistenza al calore e al fuoco	Categoria D (UL94-V2)
Caratter. di invecchiamento (ore funzionam.)	80.000
N.ro di cicli di manovra operazioni automatiche	100.000 (EN 60730-1); 30.000 (UL 60730)
Tensione impulsiva nominale	2500 V

Caratteristiche elettriche:

Alimentazione

Small, Medium, Large, Extralarge: utilizzare un trasformatore dedicato di sicurezza in classe 2 da 50 VA.
Biult-in driver: utilizzare un trasformatore dedicato di sicurezza in classe II da 100 VA.

	Vac	P (Vac)	Vdc	P (Vdc)
Small	24 Vac (+10/-15%), 50/60 Hz, fusibile esterno da 2,5 A T	45 VA	28...36 Vdc (-20/+10%) fusibile esterno da 2,5 A T	30 W
Medium				
Large				
Extralarge				
Biult-in driver		90 VA	Non ammesso	

Attenz.: per la versione "pCO5+ built-in driver" sono obbligatori l'alimentazione in alternata e il collegamento del secondario del trasformatore a terra (G0 a terra).

Morsettiera	con connettori maschio/femmina estraibili
Sezione cavi	min 0.5 mm² - max 2.5 mm²
Orologio con batteria	di serie, precisione 100 ppm
Buzzer	abilitabile da software, solo con terminale integrato
Batteria	Di tipo "bottone" al litio cod. CR2430 tensione 3 Vdc (dimen. 24x3 mm)
Classe e struttura del software	Classe A
Categ. di immunità ai surge (CEI EN 61000-4-5)	Categoria III
Dispositivo non destinato ad essere tenuto in mano quando alimentato	

Ingressi / Uscite
Ingressi/uscite universali:

Ingressi analogici, Lmax = 30 m, numero massimo	Small		Medium/Built-in driver/Extralar.		Large
sonde NTC CAREL (-50T90°C; R/T 10 kΩ ±1% a 25°C), NTC HT (0T150°C), PTC (600Ω...2200Ω), PT500 (-100T300°C), PT1000 (-100T400°C)	5		8		10
sonde PT100 (-100T400°C)	2		3 (2 su U1...U5, 1 su U6...U8)		4 (2 su U1...U5, 1 su U6...U8, 1 su U9...U10)
segnali 0...1 Vdc/0...10 Vdc (*) da sonde alimentate dal controllo	max tot 5	5	max tot 8	6	max tot 10	6
segnali 0...1 Vdc/0...10 Vdc (*) alimentati esternamente		5		8		10
ingressi 0...20 mA /4...20 mA (*) da sonde alimentate dal controllo	max tot 4	4	max tot 7	6: (max 4 su U1...U5, 3 su U6...U8)	max tot 9	6: (max 4 su U1...U5, 3 su U6...U8, 2 su U9...U10)
ingressi 0...20 mA /4...20 mA (*) alimentati esternamente		4		7: (max 4 su U1...U5, 3 su U6...U8)		9: (max 4 su U1...U5, 3 su U6...U8, 2 su U9...U10)
segnali 0...5 V (*) da sonde raziomet. alim. dal controllo	5		6			6

Precisione ingressi: ± 0,3 % f.s.
Costante di tempo per ogni ingresso: 0,5 s
Classificazione dei circuiti di misura (CEI EN 61010-1): categoria I

Ingressi digitali non optois., Lmax = 30 m, n.ro max	Small	Medium/Built-in driver/Extralar.	Large
contatti puliti	5	8	10
ingressi digitali veloci: tipo: contatto pulito, corrente max: 10 mA, freq. max: 2kHz e risoluzione: ±1 Hz	2	4: (max 2 su U1...U5, max 2 su U6...U8)	6: (max 2 su U1...U5, max 2 su U6...U8, 2 su U9...U10)

Attenzione:
- prevedere per le sonde attive (0...1 V, 0...10 V, 0...20 mA, 4...20 mA) alimentate esternamente, per evitare di danneggiare irreparabilmente il controllo, adeguate misure di protezione di corrente, che deve essere mantenuta < 100 mA; le sonde raziometriche possono essere alimentate solo dal controllo;
- all'accensione, gli ingressi/uscite universali rimangono cortocircuitati a GND per circa 500ms fino al termine della fase di configurazione.

Uscite analogiche non optois. (n.ro max), Lmax = 30 m,	Small	Medium/Built-in driver/Extralar.	Large
0...10 Vdc (*) (corrente massima 2 mA)	5	8	10
PWM (uscita 0/3.3 Vdc, corrente max 2 mA, frequenza: 2kHz asincrono, 100 Hz asincrono)	5	8	10

Alimentazione sonde e terminali

+VDC	per l'alimentazione di eventuali sonde attive è possibile utilizzare i 24/21 Vdc ± 10% (*) (P+5*/P+3*) disponibili al morsetto +VDC (J2). La corrente max erogabile è di 150 mA protetta contro i cortocircuiti.
+5VREF	per l'alimentazione delle sonde raziometriche 0...5 V utilizzare i 5 Vdc (*) (± 5%) disponibili al morsetto +5VREF (J24). La corrente massima erogabile è di 60 mA.
Vterm	P+3**********: 21 Vdc ± 10% (*); P+5**********: 24 Vdc ± 10% (*). Da impiegarsi per alimentare un terminale esterno in alternativa a quello connesso a J10, Pmax = 1,5 W

Attenz.: se la lunghezza supera i 10 m prevedere un cavo schermato con schermo connesso a terra. In ogni caso la lunghezza massima consentita è 30 m.

Note per ingressi digitali:
- separare quanto più possibile i cavi delle sonde e degli ingressi digitali dai cavi dei carichi induttivi e di potenza per evitare possibili disturbi elettromagnetici. Non inserire mai nelle stesse canaline (comprese quelle dei quadri elettrici) cavi di potenza e cavi di segnale;
- in caso di ingressi in tensione continua (24 Vdc) è indifferente collegare il + o il - al morsetto comune;
- la portata del contatto esterno degli ingressi digitali deve essere almeno pari a 5 mA.

Ingressi digitali - Uscite analogiche

Ingressi digitali (ID... IDH...)

Tipo	Optoisolati		
Lmax	30 m		
Numero massimo		nr. ingr. optoisol. a 24 Vac o 24 Vdc	nr. ingr. optois. a 24 Vac o 230 Vac (50 Hz)
	Small	8	Nessuno
	Medium/Built-in driver/ Extralarge	12	2
	Large	14	4
Tempo minimo di rilevazione impulso agli ingressi digitali	Normalm. aperto (aperto-chiuso-aperto)	200 ms	
	Normalm. chiuso (chiuso-aperto-chiuso)	400 ms	
Alimentazione degli ingressi	Esterna	IDH...: 230 Vac (+10/-15%) 50/60 Hz	
		ID...: 24 Vac (+10/-15%) 50/60 Hz o 28...36 Vdc (-20/+10%)	
Classific. dei circuiti di misura (CEI EN 61010-1)	Categoria I: 24 Vac/Vdc (J5, J7, J20); Categoria III: 230 Vac (J8, J19)		
Corrente assorbita ingressi digitali in tensione a 24 Vac/Vdc		5 mA	
Corrente assorbita ingressi digitali in tensione a 230 Vac		5 mA	

Uscite analogiche (Y...)

Tipo	0...10 V optoisolate su Y1, Y2, Y3, Y4, Y5, Y6 / a taglio di fase (PWM) optoisolate su Y3, Y4 (configurabili via softw.)			
Lmax	30 m			
Numero max	Small/Medium/Built-in driver/Extralarge		4	Y1...Y4 a 0...10 V
	Large		6	Y1...Y6 a 0...10 V
Alimentazione	esterna	24 Vac (+10/-15%) o 28...36 Vdc (+10/-20%) su VG(+), VG0(-) (*)		
Precisione	Y1...Y6	± 2% fondo scala		
Risoluzione	8 bit			
Tempo di assestam.	Y1...Y6	Da 1 s (slew rate 10 V/s) a 20 s (slew rate 0,5 V/s) selezionabile via SW		
Carico massimo	1 kΩ (10 mA)			

Avvertenze:
- per lunghezze > 10 m si prescrive un cavo schermato con schermo connesso a terra;
- ad un'uscita analogica optoisolata di tipo 0...10 Vdc si possono collegare in parallelo altre uscite dello stesso tipo, oppure una tensione esterna. La tensione risultante sarà quella maggiore. Non è garantito il corretto funzionamento nel caso si colleghino attuatori con ingresso in tensione;
- alimentare le uscite analogiche VG-VG0 con la stessa tensione presente su G-G0: connettere G a VG e G0 a VG0. Questo è valido sia per alimentazioni in alternata sia in continua; nel caso di uscite a taglio di fase (PWM) si fa notare che il sincronismo (zero crossing) è prelevato da G/G0 e solo con alimentazione 24 Vac e non Vdc.

Uscite digitali NO..., NC...

Tipo:	Relè. Corrente minima di contatto: 50 mA.
Nr. max	8: SMALL; 13: MEDIUM/ BUILT-IN DRIVER; 18: LARGE; 29: EXTRALARGE
Distanza isola-mento	Le uscite relè hanno caratteristiche diverse a seconda del modello del controllo. Le uscite sono suddivisibili in gruppi. I relè appartenenti ad uno stesso gruppo hanno tra loro iun isolamento di funzionamento e quindi devono essere sottoposti alla stessa tensione. Tra gruppo e gruppo vi è isolamento rinforzato quindi i relè possono essere sottoposti a tensioni diverse. In ogni caso tra ogni morsetto delle uscite digitali e il resto del controllo esiste il doppio isolamento.

Per quanto riguarda l'isolamento tra gruppi di relè, il tipo di relè e la potenza commutabile vedere il manuale cod. +0300020IT. Per le caratteristiche delle uscite SSR vedere il manuale cod. +0300020IT.
Modello con driver per valvola di espansione elettronica: vedere il manuale cod. +0300020IT.
(*) classe 2.

ENG

Technical characteristics

Plastic case

Installation	*Fitted on DIN rail as per DIN 43880 and IEC EN 50022*
Material	*Technopolymers*
Self-extinguishing	*V2 (according to UL94) and 850 °C (according to IEC 60695)*
Temperature for the ball pressure test	*125 °C*
Creeping current resistance	*≥ 250 V*
Colour	*White RAL 9016*
Built-in terminal	*Type PGD1 (132x64 pixel) with backlit keyboard*

Other specifications

Operating conditions	*P+(3,5)*******0**(no Built-in terminal): -40T70°C, 90% UR no-condensing (*)*
(*) with Ultracap module installed: -40T60°C	*P+(3,5)*******E**(with Built-in terminal): -20T60 °C, 90% UR no-condensing*
Storage conditions	*P+(3, 5)*******0**(no Built-in terminal): -40T70 °C, 90% UR no-condensing*
	*P+(3, 5)*******E**(with Built-in terminal): -30T70 °C, 90% UR no-condensing*
Protection index	*Models with USB port and/or with Ultracap module: IP20 in the front panel only*
	Models without USB port and without Ultracap module: IP40 in the front panel only
Control pollution situation	*2*
Class according to protection against electrical shocks	*to be integrated into Class I and/or II appliances in the versions without valve driver, Class I in versions with valve driver*
PTI of the insulating materials	*PCB: PTI250; insulation material: PTI 175*
Period of electrical stress on the insulat. parts	*Long*
Type of actions	*1C; 1Y for SSR versions*
Type of disconnection or microswitching	*Micro-switching*
Category of resistance to heat and fire	*Category D (UL94-V2)*
Aging characteristics (operational hours)	*80.000*
Number of automatic operating cycles	*100.000 (EN 60730-1); 30.000 (UL 60730)*
Rated impulse voltage	*2500 V*

Electrical characteristics

Power supply

Small, Medium, Large, Extralarge: use a dedicated safety transformer rated in Class 2 from 50 VA.
Biult-in driver: use a dedicated safety transformer rated in Class II type 100 VA.

	Vac	*P (Vac)*	*Vdc*	*P (Vdc)*
Small	*24 Vac (+10/-15%), 50/60 Hz, external fuse from 2.5 A T*	*45 VA*	*28...36 (-20/+10%) Vdc external fuse type 2.5 A T*	*30 W*
Medium				
Large				
Extralarge				
Biult-in driver		*90 VA*	*Not allowed*	

Atten.: *the pC05+ with built-in driver must be powered with alternating current and the secondary winding of the power supply transformer (G0) must be earthed.*

Terminal block	*with male/female plug-in connectors,*
Cable section	*min 0.5 mm² - max 2.5 mm²*
Clock with battery	*standard, precision 100 ppm*
Buzzer	*enabled by software, only with built-in terminal*
Battery	*Lithium "button" type code CR2430 voltage 3 Vdc (dimensions 24x3 mm)*
Software class and structure	*Class A*
Surge protection category (CEI EN 61000-4-5)	*Category III*
Device not meant to be held in the hand when receiving power	

Inputs / Outputs
Universal inputs/outputs:

Analogue inputs, Lmax = 30m, maxim. number	*Small*		*Medium/Built-in driver/Extralar.*		*Large*
Probes: NTC CAREL (-50T90°C; R/T 10 kΩ ±1% a 25°C), NTC HT (0T150°C), PTC (600Ω...2200Ω), PT500 (-100T300°C), PT1000 (-100T400°C)	*5*		*8*		*10*
PT100 probes (-100T400°C)	*2*		*3 (2 su U1...U5, 1 su U6...U8)*		*4 (2 su U1...U5, 1 su U6...U8, 1 su U9...U10)*
signals 0...1 Vdc/0...10 Vdc (*) from probes pow. by control	*max tot 5*	*5*	*6*	*max tot 10*	*6*
signals 0...1 Vdc/0...10 Vdc (*) powered externally		*5*	*max tot 8 8*		*10*
inputs 0...20 mA /4...20 mA (*) from probes powered by the control	*max tot 4*	*4*	*6: (max 4 su U1...U5, 3 su U6...U8)*	*max tot 9*	*6: (max 4 su U1...U5, 3 su U6...U8, 2 su U9...U10)*
inputs 0...20 mA /4...20 mA (*) powered externally		*4*	*max tot 7 7: (max 4 su U1...U5, 3 su U6...U8)*		*9: (max 4 su U1...U5, 3 su U6...U8, 2 su U9...U10)*
signals 0...5 V (*) from raziom. probes pow. by control	*5*		*6*	*6*	

Input precision: ± 0,3 % f.s.
Time constant for each input: 0,5 s
Classification of measuring circuits (CEI EN 61010-1): category I

Digital inputs not opt.-isolated , Lmax = 30 m, max. num.	*Small*	*Medium/Built-in driver/Extralar.*	*Large*
free contacts	*5*	*8*	*10*
fast digital inputs: type: free contact, max current: 10 mA, max freq.: 2kHz and resolution: ±1 Hz	*2*	*4: (max 2 su U1...U5, max 2 su U6...U8)*	*6: (max 2 su U1...U5, max 2 su U6...U8, 2 su U9...U10)*

Attention:
- *provide adequate current protection measures for externally powered active probes (0 to 1 V, 0 to 10 V, 0 to 20 mA, 4 to 20 mA), to prevent irreparable damage to the controller, which must be maintained at < 100 mA; the raziometric probes can be powered only by the controller;*
- *at power on, universal inputs/outputs are short circuited to GND for about 500ms up to the end of the configuration.*

Anal. outputs not opt.-isolated (max. nu.), Lmax = 30 m	*Small*	*Medium/Built-in driver/Extralar.*	*Large*
0...10 Vdc (*) (max current 2 mA)	*5*	*8*	*10*
PWM (output 0/3.3 Vdc, max. current 2 mA, frequency: 2kHz asynchronous, 100 Hz asynchronous)	*5*	*8*	*10*

Probe and terminal power supply

+VDC	*for supplying any active probes, the 24/21 Vdc ± 10% (*) (P+5*/P+3*) can be used, available to the +VDC (J2) terminal. The maximum deliverable current is 150 mA protected against short-circuits.*
+5VREF	*for supplying the 0 to 5 V raziometric probes, use the 5 Vdc (*) (± 5%) available to the +5VREF(J24) terminal. The maximum deliverable current is 60 mA.*
Vterm	*P+3**********: 21 Vdc ± 10% (*); P+5**********: 24 Vdc ± 10% (*)* *To be used to power an external terminal as an alternative to the one connected to J10, Pmax = 1.5 W*

Attent.: if the length exceeds 10m, provide a shielded cabled with the shield earthed. In any case, the maximum length permitted is 30 m.

Note for digital inputs:
- *separate the probe and digital input cables as much as possible from inductive loads and power cables, to avoid any electromagnetic disturbances. Never lay power cables and signal cables in the same cable conduits (including those for electrical panels;*
- *In the event of continuous voltage inputs (24 Vdc) it makes no difference whether the + or - is connected to the common terminal;*
- *the capacity of the external contact of the digital inputs must be at least equal to 5 mA;*

Digital inputs - Analogue outputs

Digital inputs (ID... IDH...)

Type	*Optically-isolated*		
Lmax	*30 m*		
Maximum number		*no. opt.-isolated inputs at 24 Vac or 24 Vdc*	*no. opt.-isolated inputs at 24 Vac or 230 Vac (50 Hz)*
	Small	*8*	*None*
	Medium/Built-in driver/ Extralarge	*12*	*2*
	Large	*14*	*4*
Minimum digital input pulse detection time	*Normally open (open-closed-open)*	*200 ms*	
	Normally closed (closed-open-closed)	*400 ms*	
Input power supply	*Esterna*	*IDH...: 230 Vac (+10/-15%) 50/60 Hz*	
		ID...: 24 Vac (+10/-15%) 50/60 Hz o 28...36 Vdc (-20/+10%)	
Classification of measuring circuits (CEI EN 61010-1):	*Category I: 24 Vac/Vdc (J5, J7, J20); Category III: 230 Vac (J8, J19)*		
Absorbed current digital inputs at 24 Vac/Vdc			*5 mA*
Absorbed current digital inputs at 230 Vac			*5 mA*

Analogue outputs (Y...)

Type	*0...10 V optically-isolated on Y1, Y2, Y3, Y4, Y5, Y6 / at cut-off (PWM) opt.-isolated on Y3, Y4 (configurable by softw.)*			
Lmax	*30 m*			
Max number	*Small/Medium/Built-in driver/Extralarge*		*4*	*Y1...Y4 a 0...10 V*
	Large		*6*	*Y1...Y6 a 0...10 V*
Power supply	*external*	*24 Vac (+10/-15%) o 28...36 Vdc (+10/-20%) su VG(+), VG0(-) (*)*		
Precision	*Y1...Y6*	*± 2% full scale*		
Resolution	*8 bit*			
Settling time	*Y1...Y6*	*From 1 s (slew rate 10 V/s) a 20 s (slew rate 0,5 V/s) selectable by SW*		
Maximum Load	*1 kΩ (10 mA)*			

Warnings:
- *lengths > 10 m require a shielded cable with the shield earthed;*
- *other inputs of the same type or an external voltage can be connected in parallel to an optically-isolated analogue output type 0 to 10 Vdc. The resulting voltage is the higher one. Proper operation is not guaranteed if actuators with inputs under power are connected;*
- *supply analogue VG-VG0 outputs with the same voltage present on G-G0; connect G to VG and G0 to VG0. This is valid for both alternating and continuous current; in the event of cut-off outputs (PWM) please note that synchronization (zero crossing) is taken from G/G0 and only with 24Vac and not Vdc.*

Digital outputs NO..., NC...

Type:	*Minimum relay contact current: 50 mA.*
Nr. max	*8: SMALL; 13: MEDIUM/ BUILT-IN DRIVER; 18: LARGE; 29: EXTRALARGE*
Insu-lation distance	*The relay outputs have different characteristics according to the controller model. The outputs can be divided into groups. The relays belonging to the same group have an operational insulation between them and thus must be subjected to the same voltage. Between one group and the other there is reinforced insulation, therefore the relays can be subjected to different voltages. In any case, between every terminal of the digital outputs and the rest of the controller there is double insulation.*

As for the insulation between groups of relays, the type of relay and switchable power see manual code +0300020EN. For the characterstics of the SSR outputs, see manual code +0300020EN.

Model with driver for electronic expansion valve: see manual code +0300020EN.
(*) class 2.

(ITA) MORSETTI DI COLLEGAMENTO

1	Connettore per l'alimentazione [G(+), G0(-)]
2	+Vterm: alimentazione per terminale aggiuntivo +5 VREF alimentazione per sonde raziometriche
3	Ingressi/uscite universali
4	+VDC: alimentazione per sonde attive
5	Tasto impostazione indiriz. pLAN, display secondario, LED
6	VG: aliment. a tensione A (*) per uscita analogica optois. VG0: aliment. per uscita analogica optoisolata a 0 Vac/Vdc
7	Uscite analogiche
8	ID: ingressi digitali a tensione A (*)
9	ID..: ingressi digitali a tensione A (*) IDH..: ingressi digitali a tensione B (**)
10	Connettore telefonico pLAN per terminale/ download programma applicativo
11	Connettore estraibile pLAN
12, 13, 14: Riservato	
15	Uscite digitali a relè
16	Connettore BMS2
17	Connettore FieldBus2
18	Microinterruttori selezione FieldBus/ BMS
19	Connettore FieldBus2
20	Connettore valvola elettronica A
21	Connettore valvola elettronica B
22	Connettore per modulo Ultracap esterno
23	Ingressi analogici e digitali driver esterno
24	LED segnalazione stato valvola
(*) Tensione A: 24 Vac o 28...36 Vdc	
(**) Tensione B: 230 Vac - 50/60 Hz	

Struttura

A	Tasto selezione indirizzo pLAN
B	Display indirizzo pLAN (*)
C	LED presenza alimentazione
D	LED sovraccarico
E	Microinterruttori FieldBus/BMS su porta J26 (*)
F	Porta USB Host (master) (*)
G	Porta USB Device (slave) (*)
H	Display principale
(*) presente nei modelli P+5..., non nei modelli P+3...	

(ENG) CONNECTION TERMINALS

1	Power supply connectors [G(+), G0(-)]
2	+Vterm: additional terminal power supply +5 VREF power supply for raziometric probes
3	Universal inputs/outputs
4	+VDC: power supply for active probes
5	pLAN address setup key, secondary display, LED
6	VG: power supply at voltage A (*) for optoisolat. analog.output VG0: power supply for optoisolat. analogue output at 0 Vac/Vdc
7	Analog outputs
8	ID: digital inputs at voltage A (*)
9	ID..: digital inputs at voltage A (*) IDH..: digital inputs at voltage B (**)
10	pLAN telephone connector for terminal/download application programme
11	pLAN removable connector
12, 13, 14: Reserved	
15	Relay digital outputs
16	BMS2 connector
17	FieldBus2 connector
18	FieldBus/BMS selector micro-switch
19	FieldBus2 connector
20	Electronic Valve A connector
21	Electronic Valve B connector
22	Connector for external Ultracap module
23	External driver analogue and digital inputs
24	Valve status signal LED
(*) Voltage A: 24 Vac or 28 to 36 Vdc	
(*) Voltage B: 230 Vac - 50/60 Hz	

Structure

A	pLAN address selection key
B	pLAN (*) address display
C	Power supply presence LED
D	Overcharge LED
E	FieldBus/BMS on port J26 micro-switch (*)
F	USB Host (master) Port (*)
G	USB Slave (device) port (*)
H	Main Display
(*) available in P+5... models, not available in P+3... models	

(ITA) TASTIERA (BUILT-IN e PGDE)

Tasto	Descriz.	Retro-illum.	Funzioni
⚠	Alarm	Bianco/ Rosso	• Premuto insieme a UP fornendo alimentazione permette di cambiare l'indirizzo del controllo; • premuto insieme a Enter permette di accedere alle maschere gestite da BIOS
◎	Prg	Bianco/ Giallo	-
↩	Esc	Bianco	Ritorno livello superiore
↑	UP	Bianco	• Premuto insieme a DOWN e ENTER permette di cambiare l'indirizzo del terminale (solo per terminali PGDE); • aumento valore
↵	Enter	Bianco	Conferma valore
↓	DOWN	Bianco	• Premuto insieme a UP e ENTER permette di cambiare l'indirizzo del terminale (solo per terminali PGDE); • Diminuzione valore
○	Selezione indirizzo pLAN	-	• Pressione breve: visualizzazione indirizzo pLAN • Pressione lunga (> 5s): procedura di modifica indirizzo pLAN

(ENG) KEYBOARD (BUILT-IN and PGDE)

Key	*Descriz.*	*Backlight*	*Functions*
⚠	*Alarm*	*White/ Red*	*• Pressed together with UP and supplying power allows the controller address to be changed;* *• pressed together with Enter accesses the BIOS page*
◎	*Prg*	*White/ Yellow*	-
↩	*Esc*	*White*	*return high level*
↑	*UP*	*White*	*• Pressed together with DOWN and ENTER allows the terminal address to be changed (only for PGDE terminal);* *• increase value*
↵	*Enter*	*White*	*confirm value*
↓	*DOWN*	*White*	*• Pressed together with UP and ENTER allows the terminal address to be changed (only for PGDE terminal);* *• decrease value*
○	*pLAN address selection*	-	*• short press: shows pLAN address;* *• long press (> 5s): procedure for modifying the pLAN address*

(ITA) PORTE SERIALI

Rispetto al pCO3, i controlli pCO5+ (e pCO5) possiedono una seconda porta seriale BMS sul connettore J25 (BMS2) e una seconda porta FieldBus sul connettore J26 (FBus2). Nelle schede pCO5+ versione Large e Extralarge è ancora presente il connettore J23 e riporta la scritta FBus2 come per il connettore J26. Dal punto di vista della gestione da applicativo 1Tool si tratta infatti della stessa linea seriale e si devono usare indirizzi diversi per i dispositivi connessi ai 2 connettori, mentre dal punto di vista elettrico le porte sono indipendenti (un guasto elettrico nella porta J26 non influenza la porta J23). Vedere la tab. caratteristiche tecniche.

(ENG) *SERIAL PORTS*

In comparison to the pCO3, the pCO5+ (and pCO5) controllers have a second BMS serial port on the J25 connector (BMS2) and a second FieldBus port on the J26 connector (FBus2). In the pCO5+ cards, version Large and Extralarge, the J23 is also present and is labeled FBus2 as for connector J26. From the point of view of the 1Tool application management, it is, in fact, the same serial line and different addresses must be used for the devices connected to the 2 connectors, while from the electrical point of view, the ports are independent (an electrical failure on port J26 does not effect J23). See the technical characterist. table.

Porte seriali

Seriale	Tipo/connettori	Caratteristiche
ZERO	pLAN/J10, J11	Integrata su scheda base RS485 pLAN Non optoisolata Connettori: Jack telefonico 6 vie + Estraibili 3 vie p. 5,08 Lunghezza massima: 500 m Numero massimo dispositivi collegabili: 32
UNO	BMS 1 Serial Card	Non integrata su scheda base
DUE	FieldBus 1 Serial Card	Non integrata su scheda base
TRE	BMS 2/ J25	Integrata su scheda base RS485 Slave Seriale optoisolata/non optoisolata(*) Connettore estraibile 3 vie p. 5,08 Lunghezza massima: 1000 m
QUATTRO	FieldBus 2 / J26 (e J23 su versione Large e Extralarge)	Integrata su scheda base RS485 Master/Slave (**) J23: non optoisolata, J26: optoisolata/non optoisolata Connettore estraibile 3 vie p. 5,08

Nota: utilizzare cavo schermato AWG 20-22 a coppie twistate per i +/-; (*) disponibili i 2 modelli; (**) J26 configurabile

Serial Ports

Serial	*Type/connectors*	*Specifications*
ZERO	*pLAN/J10, J11*	*Integrated on main board RS485 pLAN* *Not optically-isolated* *Connectors: 6-way telephone jack + 3-way removable p. 5.08* *Max length: 500 m* *Maximum number of connected devices: 32*
ONE	*BMS 1 Serial Card*	*Not integrated on main board*
TWO	*FieldBus 1 Serial Card*	*Not integrated on main board*
THREE	*BMS 2/ J25*	*Integrated on base card RS485 Slave* *Serial opt.isolated/not opto-isolated(*)* *3-way removable connector 5.08* *Maximum length: 1000 m*
FOUR	*FieldBus 2 / J26 (and J23 on Large and Extralarge version)*	*Integrated on base card RS485 Master/Slave (**)* *J23: not optically-isolated ,* *J26: opt.-isolated/not opt.-isolated* *3-way removable connector 5.08*

Note: use twisted pair shielded cable AWG 20-22 for the +/-; (*) available in 2 models; (**) J26 configurable

(ITA) CONFIGURAZIONE PORTA J26

Rispetto al pCO5, i controlli pCO5+ sono dotati di 4 microinterruttori per configurare la porta seriale J26 (figura):

- microinterruttori tutti "IN BASSO": porta J26 impostata con hardware FieldBus;
- microinterruttori tutti "IN ALTO": porta J26 impostata con hardware BMS(*);

La configurazione di fabbrica è: porta FieldBus.

(*) La porta seriale rimane comunque la FieldBus2 a livello software all'interno dell'ambiente di programmazione 1Tool.

(ENG) *PORT J26 CONFIGURATION*

In comparison to pCO5, the pCO5+ controllers are equipped with 4 micro-switches to configure the serial port J26 (figure):

- *all micro-switches "DOWN": port J26 set with FieldBus hardware;*
- *all micro-switches "UP": port J26 set with BMS(*) hardware;*

The factory setting is; FieldBus port.

(*) The serial port, however, remains FieldBus2 at the software level inside the 1Tool programming environment.

(ITA) CONNESSIONE IN RETE TRA CONTROLLI

Nel pCO5+ ci sono tre tipi di seriali: pLAN, FieldBus, BMS. La porta seriale Fieldbus RS485 ha hardware di tipo Master, mentre la porta seriale BMS RS485 ha hardware di tipo Slave. I protocolli da utilizzare sulla porta Fieldbus RS485 sono, per natura stessa della porta, di tipo Master (Carel Master o Modbus RTU Master), anche se possono essere utilizzati in casi particolari quelli di tipo Slave (Carel Slave o Modbus RTU Slave), con i dovuti accorgimenti. Analogamente sulla porta BMS RS485, i protocolli da utilizzare sono di tipo Slave, anche se con i dovuti accorgimenti è possibile avere protocolli di tipo Master.

Nota: la rete pLAN è multi-master: ogni controllo può essere contemporaneamente Master o Slave.

(ENG) *NETWORK CONNECTION BETWEEN CONTROLLERS*

In the pCO5+ there are three types of serials: pLAN, FieldBus and BMS. The RS485 Fieldbus port has Master type hardware while the RS485 BMS port has Slave type hardware. The protocols to be used on the RS485 Fieldbus port are, due to the nature of the port itself, Master type (Carel Master or Modbus RTU Master), even if Slave type (Carel Slave or Modbus RTU Slave) can be used in certain cases with the appropriate expedients. Similarly, on the RS485 BMS port, the protocols to be used are Slave type, even if with the appropriate expedients, Master-type protocols are possible.

***Note:** the pLAN network is multi-master: each controller can be Master or Slave at the same time.*

(ITA) ETICHETTAT. INGRESSI / USCITE

I controlli pCO5+ si differenziano per la taglia e sono provvisti di ingressi e uscite e alimentazione alle sonde attive adatte per le varie applicazioni. Le caratteristiche che dipendono dalla taglia sono:

- numero massimo e natura degli ingressi/uscite;
- presenza o meno del display integrato;
- presenza del driver integrato per valvola di espansione.

Etich.	Tipo di segnale
U...	Ingressi/uscite universali, configurabili via software come: Ingressi analogici: - sensori NTC , PTC, PT500, PT1000 - sensori PT100 - segnali 0...1 Vdc o 0...10 Vdc - segnali 0/4...20 mA - segnali 0...5 V per sonde raziometriche Ingressi digitali (non optoisolati): - contatti puliti (non optoisolati) - ingressi digitali veloci Uscite analogiche (non optoisolate): - segnali 0...10 Vdc - segnali PWM
Y...	Uscite analogiche 0...10 Vdc, uscite PWM
ID...	Ingresso digitale a 24 Vac o 28...36 Vdc
ID...H	Ingresso digitale a 230 Vac
NO...	Uscita a relè, contatto normalmente aperto
NC...	Uscita a relè, contatto normalmente chiuso
C...	Uscita a relè, comune
Tx/Rx, GND	Porta seriale

(ENG) *INPUTS/ OUTPUTS LABEL*

The pCO5+ controllers are differentiated by their size and are equipped with inputs and outputs and active probe power supplies that are suitable for the various applications. The size-related characteristics are:

- *max. number and nature of the inputs/outputs;*
- *whether or not it has an integrated display;*
- *presence of the integrated driver for the expansion valve*

Label	Signal type
U...	Universal inputs/outputs, configur. via software such as: Analogue inputs: - sensors NTC , PTC, PT500, PT1000 - sensors PT100 - signals 0 to 1 Vdc or 0 to 10 Vdc - signals 0/4 to 20 mA -signals 0 to 5 V for raziometric probes Digital inputs (not opto-isolated): - free contacts (not opto-isolated) - fast digital inputs Analogue outputs (not opto-isolated): - signals 0 to 10 Vdc -signals PWM
Y...	Analogue outputs 0 to 10 Vdc, PWM outputs
ID...	Digital inputs to 24 Vac or 28 to 36 Vdc
ID...H	Digital inputs to 230 Vac
NO...	Relay outputs, contact normally open
NC...	Relay outputs, contact normally closed
C...	Relay outputs, common
Tx/Rx, GND	Serial port

(ITA) COLLEGAMENTO TERMINALE

Il controllo e il terminale sono connessi in rete pLAN.

1: controllo pCO singolo

Nel collegamento del controllo al terminale occorre tener presente i seguenti vincoli:

- la lunghezza totale della rete pLAN non deve superare i 500 m. Quindi se il terminale è stato remotato la lunghezza del cavo del terminale entra nel computo totale della lunghezza;
- il cavo telefonico non schermato si può utilizzare per una lunghezza massima di 50 m. Oltre questa lunghezza utilizzare un cavo schermato tripolare;
- oltre i 200 m l'alimentazione del terminale deve essere fornita separatamente;
- è possibile collegare al massimo 3 terminali allo stesso controllo pCO. I terminali devono essere dello stesso tipo (es. tutti PGD1). 1 terminale è alimentato dal controllo, gli altri due sono alimentati esternamente;
- tranne PGD0/ PGD1/PGDE gli altri terminali vanno alimentati con alimentazione separata.

2: Controllo pCO in rete pLAN

Nel caso di terminale connesso ad un controllo pCO, a sua volta collegato in rete pLAN ad altri controlli, il terminale è alimentato direttamente dal controllo. Prestare attenzione per evitare che una doppia alimentazione raggiunga il terminale. A questo scopo impostare i ponticelli J14 e J15 della scheda TCONN6J000, tramite i quali è possibile interrompere il passaggio della corrente di alimentazione.

Impostazione indirizzo pLAN

Procedura:

1. premere per 5 s il tasto A. L'indirizzo pLAN inizierà a lampeggiare;
2. premere ripetutamente o tenere premuto il tasto fino a raggiungere l'indirizzo desiderato (es. 7); estrarre il cacciavite;
3. attendere finché l'indirizzo comincia a lampeggiare velocemente. In questa fase l'indirizzo è memorizzato ma non ancora attivo per il programma applicativo;
4. togliere alimentazione al controllo;
5. ridare alimentazione al controllo. Ora l'indirizzo è attivato.

Impostazione dell'indirizzo del terminale e connessione controllo-terminale

Dopo aver impostato l'indirizzo del controllo (vedere paragrafo precedente), per stabilire la connessione controllo-terminale occorre impostare l'indirizzo del terminale. Seguire la procedura descritta nel manuale d'uso cod. +03000020IT.

(ENG) *CONNECTING THE TERMINAL*

CONNECTING THE TERMINAL

The controller and terminal are connect in the pLAN network

1: pCO single controller

In connecting the controller to the terminal, the following requirements must be applied:

- *the total length of the pLAN network must not exceed 500m. Therefore, if the terminal is remote, the length of the cable from the terminal is part of the total length computation;*
- *unshielded telephone cable can be used for a max. length of 50m. If this length is exceeded, us a tri-polar shielded cable;*
- *over 200 m, power supply must be provided separately to the terminal;*
- *a max. of 3 terminals can be connected to the same pCO controller The terminals must be of the same type (e.g., type PGD1). 1 terminal is supplied by the controller, the other two are externally powered.*
- *except for PGD1/PGD1/PGDE, the other terminals are powered separately.*

2: pCO controller in pLAN network

In the case of a terminal connected to a pCO controller which is then connected to other controllers in the pLAN network, the terminal is supplied directly by the controller. Pay close attention to prevent the terminal from receiving a double power supply. For this purpose, set jumpers J14 and J15 on the TCONN6J000 card, through which the passage of the power supply can be interrupted

pLAN address setup

Procedure:

1. *press key A for 5 seconds. The pLAN address will start to flash;*
2. *press the key repeatedly or hold it down until the desired address is reached (e.g., 7); remove the screwdriver;*
3. *wait until the address starts to flash quickly. In this phase the address is saved but it is not yet active in the program;*
4. *remove power from the controller;*
5. *return power to the controller; The address is now active*

Setting the terminal address and controller-terminal connection

After having set the controller address (see the previous paragraph), in order to establish the controller-terminal connection, the terminal address must be set. Follow the procedure described in user manual code +03000020EN.

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CAREL

CAREL INDUSTRIES HQs
Via dell'Industria, 11 - 35020 Brugine - Padova (Italy)
Tel. (+39) 0499716611 – Fax (+39) 0499716600 – http://www.carel.com – e-mail: carel@carel.com

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+0500038IE - rel. 1.5 - 20.01.2015

pGD touch PGDT10000FR10-PGDT13000FR10: Terminale utente pGD Touch 10" / 13" - *User terminal pGD Touch 10" / 13"*

CAREL

Installazione e montaggio / *Assembly and installation*

Dimensioni e forature / *Dimensions and drilling template* (in mm/inc.)

Fig.1

Model	A	B	C	H	L
pGD 10	276 (10.86")	221 (8.7")	56 (2.2")	232 (9.13")	287 (11.30")
pGD 13	326 (12.83")	256 (10.07")	56 (2.2")	267 (10.51")	337 (13.22")

Tab. 1

Fissaggio supporti / *Fixing bracket*

Fig.2

Nota: avvitare ogni vite di fissaggio fino a quando l'angolo della cornice poggerà sul pannello. / *Screw each fixing screw until the bezel corner gets in contact with the panel.*

Applicazione guarnizione / *Applying the gasket*

Fig.3

Legenda:

A. Guarnizione / *Gasket*
B. Foratura per il montaggio / *Installation cut-out*

Tab. 3

Collegamento elettrico / *Power supply connection*

Fig.4

Legenda:

1. Porta seriale / Serial Port
2. 2x porta Ethernet / 2x Ethernet Port
3. porta USB (versione 2.0 - 1.1) / USB port (version 2.0 - 1.1)
4. porta USB (versione 2.0 solo alta velocità)
   USB port (version 2.0 High speed only)
5. Alimentazione / Power Supply

Tab. 2

WARNING: separate as much as possible the probe and digital input signal cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance. Never run power cables (including the electrical panel wiring) and signal cables in the same conduits.

IMPORTANT WARNINGS

The CAREL product is a state-of-the-art product, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the website www.carel.com. - The client (builder, developer or installer of the final equipment) assumes every responsibility and risk relating to the phase of configuration the product in order to reach the expected results in relation to the specific final installation and/or equipment. The lack of such phase of study, which is requested/indicated in the user manual, can cause the final product to malfunction of which CAREL can not be held responsible. The final client must use the product only in the manner described in the documentation related to the product itself. The liability of CAREL in relation to its own product is regulated by CAREL's general contract conditions edited on the website www.carel.com and/or by specific agreements with clients.

Descrizione

I terminali grafici pGD Touch da 10 e 13 pollici appartengono alla famiglia di terminali touch screen pensata per rendere semplice e intuitivo interfacciamento dell'utente con i controlli della famiglia pCO Sistema.
La tecnologia elettronica utilizzata e il nuovo display a 65'000 colori permettono di gestire immagini ad alta risoluzione e funzionalità avanzate per ottenere un elevato standard estetico. Il pannello touch screen, inoltre, facilita l'interazione uomo-macchina rendendo, di fatto, più facile la navigazione tra le varie schermate.

Codici modelli

Codice	Dimensione display	Risoluzione
PGDT10000FR10	10.4 pollici	800x600 (SVGA)
PGDT13000FR10	13.3 pollici	1280x800 (WXGA)

Codici accessori

Codice	Descrizione
PGTA00TRF0	Alimentatore 230 VAC – 24 VDC per guida DIN
PGTA00CNV0	Cavo adattatore DB9 per RS485 lunghezza 2 m

Avvertenze per l'installazione

Evitare il montaggio delle schede in ambienti che presentino le seguenti caratteristiche:

- umidità relativa maggiore di quanto indicato nelle specifiche tecniche;
- forti vibrazioni o urti;
- esposizione ad atmosfere aggressive ed inquinanti (es.: gas solforici e ammoniacali, nebbie saline, fumi) con conseguente corrosione e/o ossidazione;
- elevate interferenze magnetiche e/o radiofrequenze (evitare quindi l'installazione delle macchine vicino ad antenne trasmittenti);
- esposizione all'irraggiamento solare diretto e agli agenti atmosferici in genere;
- ampie e rapide fluttuazioni della temperatura ambiente;
- ambienti ove sono presenti esplosivi o miscele di gas infiammabili;
- evitare di avvicinarsi con le dita ai componenti elettronici montati sulle schede per evitare scariche elettrostatiche (estremamente dannose) dall'operatore verso i componenti stessi.

Avvertenze generali

1. **I terminale pGDTouch 10" e 13" possono essere alimentati solo in corrente continua.**
2. Una tensione di alimentazione elettrica diversa da quella prescritta può danneggiare seriamente il sistema;
3. Utilizzare capicorda adatti per i morsetti in uso. Allentare ogni vite ed inserirvi i capicorda, quindi serrare le viti. Ad operazione ultimata tirare leggermente i cavi per verificarne il corretto serraggio;
4. L'uso a temperature particolarmente basse può causare una visibile diminuzione della velocità di risposta del display. Questo è da ritenersi normale e non è indice di malfunzionamento.

Aggiornamento Runtime

Copiare il pacchetto di aggiornamento contenente il Runtime in una chiave USB e successivamente collegare la chiave USB al pGDTouch.
Tenere premuto il dito sullo schermo del terminale pGD Touch per alcuni secondi fino a che il menu di scelta rapida sarà visualizzato.

Selezionare "Update…" per avviare la procedura di aggiornamento Runtime. L'utility per l'aggiornamento del Runtime si avvierà ed apparirà la seguente finestra.

Selezionare "Auto select best match" e premere next, in questo modo verrà avviata la procedura di aggiornamento.

Attendere che la procedura sia terminata e premere "Close".

Description

The pGD Touch 10 and 13 inch graphic terminals are part of the family of touchscreen terminals designed to simplify user interface with the pCO sistema. family controllers
The electronic technology used and the new 65,000 colour display means high resolution images and advanced functions are available for a superior appearance. The touchscreen panel makes interaction between the user and the unit much easier by simplifying navigation between the various screens.

Model codes

Code	Display size	Resolution
PGDT10000FR10	10.4 inches	800x600 (SVGA)
PGDT13000FR10	13.3 inches	1280x800 (WXGA)

Accessory codes

Code	Description
PGTA00TRF0	230 VAC – 24 VDC power supply for DIN rail
PGTA00CNV0	DB9 adapter cable for RS485, 2 m long

Installation warnings

Do not install the boards in environments with the following characteristics:

- relative humidity greater than the value specified in the technical specifications;
- strong vibrations or knocks;
- exposure to aggressive and polluting atmospheres (e.g.: sulphur and ammonia fumes, saline mist, smoke) so as to avoid corrosion and/or oxidation;
- strong magnetic and/or radio frequency interference (therefore avoid installing the units near transmitting antennae);
- exposure to direct sunlight or the elements in general;
- large and rapid fluctuations in the room temperature;
- environments where explosives or mixes of flammable gases are present;
- avoid touching or nearly touching the electronic components fitted on the boards to avoid electrostatic discharges (extremely damaging) from the operator to the components.

General warnings

1. **The pGD Touch 10" and 13"' terminals are for DC power supply only.**
2. Power supplies other than those specified may seriously damage the system;
3. Use cable ends suitable for the corresponding terminals. Loosen each screw and insert the cable ends, then tighten the screws. When finished, slightly tug the cables to check they are sufficiently tight;
4. Operation at low temperatures may cause a visible decline in the response speed of the display. This should be considered normal and does not indicate a malfunction.

Runtime update

Copy the update package containing the Runtime to a USB pendrive and then plug the pendrive into the pGDTouch.
Touch and hold the pGD Touch terminal screen for a few seconds until the shortcut menu is displayed.

Select "Update…" to start the Runtime update procedure. The Runtime update utility will start and the following window will be displayed.

Select "Auto select best match" and then press next to start the update procedure.

Wait for the procedure to end and press "Close".

Alimentazione / *Power supply*

⚠ Alimentatore a bassissima tensione di sicurezza/sorgente di potenza limitata / *Extra low voltage power supply / Limited power source.*

Fig.5

⚠ Non aprire l'involucro dei pannelli quando sono alimentati / *Don't open the panel rear cover when the power supply is applied.*

Fig.6

Verificare che l'alimentatore sia in grado di erogare la potenza necessaria per il corretto funzionamento dell'apparecchiatura. E' possibile ordinare l'alimentatore 230Vac/24Vdc - codice PGTA00TRF0. / *Ensure that the power supply has enough power capacity for the operation of the devices. The 230 Vac/24Vdc power supply - code PGTA00TRF0 can be ordered.*

Collegamenti seriali / *Serial conncetions*

PLC PORT: Com 1 - PC/PRINTER PORT: Com2

Fig. 7

Pin	Description
1	GND
2	-
3	TX/CHA-
4	RX/CHB-
5	-
6	+5 V output
7	CTS/CHB+
8	RTS/CHA+
9	-

Per effettuare il collegamento con gli strumenti Carel in RS485 utilizzare l'apposito cavo adattatore PGTA00CNV0. / *To make the RS485 connection to Carel instruments use the special adapter cable code PGTA00CNV0.*

Caratteristiche PGTA00CNV0	*PGTA00CNV0 Technical specifications*
lunghezza: 2 m	*lenght*: 2 m
Il cavo è dotato di connettore DB9 maschio e resistenze interne di polarizzazione linea	*The cable is fitted with a DB9 male connector and internal resistance for line polarisation*
terminazioni: Db9 maschio e fili sguainati con occhiello per collegamento a terra della calza	*terminations: DB9 male and stripped wires with eyelet for earthing the shield*

Per il collegamento al pCO seguire i colori indicati in figura:
To connect the pCO follow the colours indicated in the figure:

Fig. 8

Regole per lo smaltimento / *Guidelines for disposal*

- Non smaltire il prodotto come rifiuto solido urbano ma smaltirlo negli appositi centri di raccolta.
- Il prodotto contiene una batteria ed è quindi necessario rimuoverla separandola dal resto del prodotto seguendo le istruzioni riportate di seguito prima di procedere al suo smaltimento.
- Un uso improprio o uno smaltimento non corretto potrebbe avere effetti negativi sulla salute umana e sull'ambiente.
- Per lo smaltimento vanno utilizzati i sistemi di raccolta pubblici o privati previsti dalle leggi locali.
- In caso di smaltimento abusivo dei rifiuti elettrici ed elettronici sono previste sanzioni stabilite dalle vigenti normative locali in materia di smaltimento.

- *Do not dispose of the product as municipal waste; it must be disposed of through specialist waste disposal centres.*
- *The product contains a battery that must be removed and separated from the rest of the product according to the instructions provided, before disposing of the product.*
- *Improper use or incorrect disposal of the product may negative effects on human health and on the environment.*
- *The public or private waste collection systems defined by local legislation must be used for disposal.*
- *In the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.*

Fig. 9

Smaltimento del prodotto: l'apparecchiatura (o il prodotto) deve essere oggetto di raccolta separata in conformità alle vigenti normative locali in materia di smaltimento. / ***Disposal of the product:*** *the appliance (or the product) must be disposed of separately in accordance with the local waste disposal legislation in force.*

Caratteristiche tecniche

	pGD10"	pGD13"
Display		
Tipo	TFT	
Resoluzione	800x600, SVGA	1280x800, WXGA
Area display attiva	10.4" diagonal	13"3 diagonal
Colori	64 K	
Retro-illuminazione	LED	
Luminosità	300 Cd/m² typ.	
Regolazione luminosità	Si	
Requisiti di sistema		
Sistema operativo	Microsoft Windows CE 6.0	
Memoria utente	256 MB Flash	
RAM CPU | MIPS	256 MB DDR	
Interfaccia operativa		
Touchscreen	Analog resistive	
Indicatori LED utente	1 (dual core)	
Interfacce		
Porta Ethernet	2 10/100 Mbit with intergrated switch	
Porta USB	Host interface, (1 vers. 2.0, 1 vers. 2.0 e 1.1)	
Porta Seriale 1: Com1	RS232, RS485, RS422, configurabile via software	
Memory card	SD Card Slot	
Funzionalità		
Grafica vettoriale	Si, incluso supporto SVG 1.0	
Oggetti dinamici	Si. Visibilità, opacità, posizione, dimensione, rotazione per molti tipi di oggetti	
Font-TrueType	Si	
Multi-Protocollo	Sì, massimo 2 driver	
Storico e trend	Si. Limitato alla memoria della Flash memory	
Multi-lingue	Si, con impostazione della lingua run-timee limitato solo dalla memoria disponibile	
Recipes (ricette)	Si. Limitato alla memoria della Flash memory	
Allarmi	Si	
Lista eventi	Si	
Passwords	Si	
Hardware Real Time Clock	Si, con batteria di back-up	
Screen saver	Sì	
Buzzer	"Beep" alla pressione del touch (configurabile)	
Ratings		
Alimentazione	24 Vdc (18...30 Vdc)	
Corrente assorbita	0,95 A a 24 Vdc (max.)	1,15 A a 24 Vdc (max.)
Fusibile	Automatico	
Peso	appross. 2,1 kg	appross. 2,8 kg
Batteria	Ricaricabile a litio, non sostituibile dall'utente	
Condizioni ambientali		
Temperatura di lavoro	0...50 °C (installazione verticale)	
Temperatura di immagazzinamento	-20...70 °C	
Umidità i lavoro e immagazzinamento	5 – 85 % umidità relativa, non-condensante	
Grado di protezione	IP65 (front panel) - IP20 (rear)	
Dimensioni		
Pannello frontale LxH	287x232 mm	337x267 mm (13.22x10.51")
Foratura AxB	276x221 mm	326x256 mm (12.83x10.07")
Profondità D+T	56mm + 4mm	56+4 mm (2.20+0.16")

L'utilizzo di queste apparecchiature in ambienti residenziali, commerciali e dell'industria leggera è permesso solo nel caso in cui vengano prese le misure speciali per ottenere la conformità alla IEC61000-6-3.

CAREL si riserva la possibilità di apportare modifiche o cambiamenti ai propri prodotti senza alcun preavviso.

Technical Specification

	pGD10"	pGD13"
Display		
Type	TFT	
Resolution	800x600, SVGA	1280x800, WXGA
Active display area	10.4" diagonal	13"3 diagonal
Colours	64 K	
Backlight	LED	
Brightness	300 Cd/m² typ.	
Dimming	Yes	
System resources		
Operating System	Microsoft Windows CE 6.0	
User memory	256 MB Flash	
RAM CPU | MIPS	256 MB DDR	
Operator Interface		
Touchscreen	Analogue resistive	
User LED indicators	1 (dual core)	
Interfaces		
Ethernet port	2 10/100 Mbit with intergrated switch	
USB port	Host interface, (1 vers. 2.0, 1 vers. 2.0 e 1.1)	
Serial Port 1: Com1	RS232, RS485, RS422, software configurable	
Memory card	SD Card Slot	
Functions and features		
Vector graphics	Yes, includes SVG 1.0 support	
Object dynamics	Yes. Visibility, opacity, position size, rotation for object types.	
TrueType fonts	Yes	
Multiple driver commun.	Yes, max 2 drivers	
Data acquisition and trend presentation	Yes. Flash memory storage limited only by available memory	
Multilanguage	Yes, number of run-time languages limited by available memory	
Recipes	Yes. Flash memory storage limited by available mem.	
Alarms	Yes	
Event list	Yes	
Passwords	Yes	
Hardware Real Time Clock	Yes, with battery back-up	
Screen saver	Yes	
Buzzer	Yes, audible feedback for touchscreen	
Ratings		
Power supply voltage	24 Vdc (18 to 30 Vdc)	
Current consumption	0,95 A a 24 Vdc (max.)	1.15 A a 24 Vdc (max.)
Fuse	Automatic	
Weight	Approx 2.1 kg	Approx 2.8 kg
Battery	Rechargeable Lithium battery, not user-replaceable	
Environmental conditions		
Operating temperature	0...50 °C (vertical installation)	
Storage temperature	-20...70 °C	
Operating and storage humidity	5 – 85 % relative humidity, non-condensing	
Protection class	IP65 (front panel) - IP20 (rear)	
Dimensions		
Faceplate LxH	287x232 mm	337x267 mm (13.22x10.51")
Cutout AxB	276x221 mm	326x256 mm (12.83x10.07")
Depth D+T	56mm + 4mm	56+4 mm (2.20+0.16")

These devices may only be used in residential, commercial and light industrial environments if special measures are taken to ensure conformity to IEC61000-6-3.

CAREL reserves the right to modify the features of its products without prior notice.

Schema per collegamento a pCO⁵ / *Connection to pCO⁵*

Fig. 10

Fig. 11

CAREL Industries HQs
Via dell'Industria, 11 - 35020 Brugine - Padova (Italy)
Tel. (+39) 0499716611 – Fax (+39) 0499716600 – www.carel.com – e-mail: carel@carel.com

+050001485 - rel. 1.2 date 29.05.2014

CLEANVENT

Combined Air (Deaerator) & Dirt Separator.

1 High capacity auto air vent
2 3-Way Valve / Bleed Valve
3 Drain Valve

Dimensions (mm)								
Model No.	A	B	C	D	E	F	G	Tested to
CVAD-50	50	430	300	170	25	380	680	21 bar
CVAD-65	65	430	300	170	25	380	680	21 bar
CVAD-80	80	490	360	220	25	440	800	21 bar
CVAD-100	100	490	360	220	25	440	800	21 bar
CVAD-125	125	630	470	325	25	550	1020	21 bar
CVAD-150	150	630	470	325	25	550	1020	21 bar
CVAD-200	200	810	625	410	50	625	1250	21 bar
CVAD-250	250	880	775	510	50	775	1550	21 bar
CVAD-300	300	1100	875	610	50	875	1750	21 bar
CVAD-350	350	1500	950	770	50	950	1900	21 bar
CVAD-400	400	1500	1125	770	50	1125	2250	21 bar
CVAD-450	450	1750	1125	920	50	1125	225	21 bar
CVAD-500	500	2000	1175	1220	50	1175	2350	21 bar
CVAD-600	600	2000	1325	1220	50	1325	2650	21 bar

Dearation

The word Dearation describes the removal of dissolved gases from liquids such as air from water. When water is heated or the pressure reduced gas microbubbles are released into the system. Microbubbles can be the cause of major problems such as pump failure, corrosion and energy loss.

The Solution

As an aid to system cleaning the CleanVent range has been developed by Fabricated Products (UK) to remove potentially damaging particles from both hot and chilled water systems. It is comprised of a very fine stainless-steel Concentrator capable of stopping debris down to 5 micron. Through simple & cost effective maintenance the dirt can be flushed away to removing all the damaging particles in the system.

Features and Benefits

- It is comprised of a very fine stainless-steel Concentrator capable of stopping debris down to 5 micron.
- Greatly reduced commissioning times after initial fill.
- Longer system life (through air and dirt elimination)
- Low-pressure drop
- Bi-directional flow
- Maximum Temperature. 110 °c. Higher temperature units available on request.
- Tested to 21 bar
- All stainless steel construction.
- Air collects in the air chamber before being automatically vented
- Floating dirt can be removed by opening the valve situated under the air vent.
- The same valve is used for releasing air when filling the system
- Large collector ensures that flushing is only required now and then
- Can be flushed while fully operational (no need to shut down)
- An internal stainless steel concentrator to aid removal of air and dirt.
- Smooth surfaces with Stainless Steel lead to lower friction
- Stainless will not degrade in service thanks to its excellent resistance to corrosion.

- Stainless Steel is extensively more resistant to oxidation by water and biocides than carbon steel. Therefore Stainless Steels are not contributing to oxidation, sludge's etc;
- Thermal properties of stainless steel. They are far superior to iron or carbon steel.
- Maximum flow rate up to 3m/sec

Stainless Steel: Safe, Clean, Efficient and Hygienic

- Stainless is highly resistant against micro bacteria attacks plus lower bacteria colonization
- Hygienic and cleanable material (Smooth surface internally & externally). Due to their very high passive film (protecting the surface)
- Lower adhesion of deposits (dirt and sludge) with the smooth internals of Stainless Steels. Sludge & magnetite is washed/ removed from the collection chamber far easier than the inferior iron/ carbon steel
- Stability, Stainless Steel is basically inert in water. Leaching of alloying elements is within safe limits. As a result, they provide better quality water. No turbidity problems. All resulting in less bacterial slime, low energy consumption, low cleaning costs, good for conveying wet solids.
- Excellent durability and abrasion resistance, as Stainless Steels are resistant to crevice corrosion, cavitations and wear in pure and polluted waters as well as in atmosphere (even polluted), they are cost effective for long term use and do not cause environmental pollution.

CleanVent location

This combined unit (model ref CVAD) must be installed at the hottest part of the system (before the pumps). In a heating system this is the main flow from the boilers.
In a chilled water system the unit must be located in the return close to the chiller.
The static head must not exceed 60 metres in a Heating system.
Maximum static head must not exceed 40 metres in a chilled water system.
N.B. if the static head is greater than

Commissioning

The CleanVent requires no special commissioning. All units are fitted with a fast bleed valve, which should be used when initially filling the system. The same valve is used for draining off floating scum and also prevents the possibility of dirt clogging the air vent. Maintenance will be required to remove trapped dirt and sludge. Opening the ball valve at the bottom of the unit does this. The valve may be opened while the system is under pressure.
Scalding is a danger at high pressures

these figures the efficiency of the CleanVent & MagVent is reduced

Flanges

All flanges are drilled to BS4504 PN16 as standard. Other flange ratings are available on request.

The CleanVent unit is maintenance free

and temperatures. Ensure that the water is safely piped to drain before opening the valve.

The system pressure will flush the dirt out. Leave the valve open until the collected dirt has been flushed out; repeat this operation every few days. Once the water is clear it may be possible to drain every 6 months or so depending on the size and age of the system.

Most of the dissolved air will be removed in a few days. However this may vary from system to system .In large systems it may take several weeks.

Dirt separators can only remove dirt that is circulating.

Drain valve

All models are supplied with a ball valve for draining the collected dirt and sludge.

CLEANVENT

An Air （Deaerator） Separator.

1 High capacity auto air vent

2 Fast bleed Valve

Dimensions （mm）							
Model No.	A	B	C	D	F	G	Tested to
CVA-50	50	430	114	170	390	504	21 bar
CVA-65	65	430	120	170	384	504	21 bar
CVA-80	80	490	141	220	459	600	21 bar
CVA-100	100	490	154	220	446	600	21 bar
CVA-125	125	630	193	325	585	778	21 bar
CVA-150	150	630	207	325	571	778	21 bar
CVA-200	200	810	251	410	649	900	21 bar
CVA-250	250	880	303	510	835	1138	21 bar
CVA-300	300	1100	353	610	947	1300	21 bar
CVA-350	350	1500	406	770	1025	1431	21 bar
CVA-400	400	1500	432	770	1262	1694	21 bar
CVA-450	450	1750	495	920	1218	1713	21 bar
CVA-500	500	2000	595	1220	1230	1825	21 bar

Dearation

The word Dearation describes the removal of dissolved gases from liquids such as air from water. When water is heated or the pressure reduced gas microbubbles are released into the system. Microbubbles can be the cause of major problems such as pump failure, corrosion and energy loss.

The Solution

The stainless steel CleanVent Air Separator Installed at the hottest point in the system the stainless steel CleanVent will eliminate these micro bubbles from heating and chilled water systems.

Features and Benefits

- Greatly reduced commissioning times after initial fill.
- Longer system life （through air elimination）
- Low-pressure drop
- Bi-directional flow
- Maximum Temperature. 110 °c. Higher temperature units available on request.
- Tested to 21 bar
- All stainless steel construction.
- Air collects in the air chamber before being automatically vented
- An internal stainless steel concentrator to aid removal of air
- Smooth surfaces with Stainless Steel lead to lower friction
- Stainless will not degrade in service thanks to its excellent resistance to corrosion.
- Stainless Steel is extensively more resistant to oxidation by water and biocides than carbon steel. Therefore Stainless Steels are not contributing to oxidation, sludge's etc;
- Thermal properties of stainless steel. They are far superior to iron or carbon steel.
- Maximum flow rate up to 3m/sec

Stainless Steel: Safe, Clean, Efficient and Hygienic

- Stainless is highly resistant against micro bacteria attacks plus lower bacteria colonization
- Hygienic and cleanable material (Smooth surface internally & externally). Due to their very high passive film (protecting the surface)
- Lower adhesion of deposits (dirt and sludge) with the smooth internals of Stainless Steels. Sludge & magnetite is washed/ removed from the collection chamber far easier than the inferior iron/ carbon steel
- Stability, Stainless Steel is basically inert in water. Leaching of alloying elements is within safe limits. As a result, they provide better quality water. No turbidity problems. All resulting in less bacterial slime, low energy consumption, low cleaning costs, good for conveying wet solids.
- Excellent durability and abrasion resistance, as Stainless Steels are resistant to crevice corrosion, cavitations and wear in pure and polluted waters as well as in atmosphere (even polluted), they are cost effective for long term use and do not cause environmental pollution.

CleanVent location

This unit (our model ref CVA) must be installed at the hottest part of the system (before the pumps). In a heating system this is the main flow from the boilers.
In a chilled water system the unit must be located in the return close to the chiller.
The static head must not exceed 60 metres in a Heating system.
Maximum static head must not exceed 40 metres in a chilled water system.
N.B. if the static head is greater than these figures the efficiency of the CleanVent & MagVent is reduced

Commissioning

The CleanVent requires no special commissioning. All units are fitted with a fast bleed valve, which should be used when initially filling the system. The same valve is used for draining off floating scum and also prevents the possibility of dirt clogging the air vent.
Most of the dissolved air will be removed in a few days. However this may vary from system to system, In large systems it may take several weeks.

Flanges

All flanges are drilled to BS4504 PN16 as standard. Other flange ratings are available on request.

1 YEAR
WARRANTY

User's Guide

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Germany/Austria:

Daimlerstrasse 26
D-75392 Deckenpfronn, Germany
Toll-Free: 0 800 6397678 TEL: +49 (0) 7059 9398-0
FAX: +49 (0) 7056 9398-29 e-mail: info@omega.de

United Kingdom:
ISO 9001 Certified

OMEGA Engineering Ltd.
One Omega Drive, River Bend Technology Centre, Northbank
Irlam, Manchester M44 5BD England
Toll-Free: 0800-488-488 TEL: +44 (0)161 777-6611
FAX: +44 (0)161 777-6622 e-mail: sales@omega.co.uk

It is the policy of OMEGA Engineering, Inc. to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.
WARNING: These products are not designed for use in, and should not be used for, human applications.

Offered in liquid and gas sensor types, the general purpose flow switch provides reliable low or no-flow detection of relatively clean, non-coating media with one 1A relay output. Liquid examples in clued water and acetic acid. Available in Polypropylene-PPS or PVDF, the short flow sensor is used in pipe or ducting from ½" to 1-1/2", and the long flow sensor is used in 2" and up. The flow switch set point may be adjusted from 0.,04 to 3 fps in liquids or 1 to 90 fps in gases as a low-flow alarm. The flow sensor is best applied in applications with relatively constant temperatures.

New Features

- Rugged Polypropylene-PPS or PVDF sensor for corrosive liquids and gasses.
- Adjustable set point with LED for flow or no-flow status indication.
- 60VA relay selectable NO or NC via power supply wiring polarity
- Solid State sensor is not damaged by over-ranging flow velocities.

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SPECIFICATIONS	**Step Two**

Set point range:	FST-200: .04 to 3 fps (.012 to .91 mps)
	FST-300: 1 to .90 fps (.3 to 27 mps)
Factory set point:	FST-200: .2 fps (.06 mps)
	FST-300: 10 fps (3 mps)
Repeatability:	±.5% of set point @ fixed temp.
Response time:	1-10 seconds
Set point adjust.:	Potentiometer
LED indication:	Flow Status
Viscosity range:	1-200 centipoise (FST-200 series only)
Supply Voltage:	14-36 VDC
Consumption:	70 mA maximum
Contact type:	(1) SPST relay
Contact rating:	60 VA, 1A max
Contact output:	Selectable NO/NC
Process temp.:	F:32° to 140°
	C: 0° to 60°
Electronics temp.	F: -40° to 140°
	C: -40° to 60°
Pressure:	150 psi (10 bar) @ 25°C., derated @ 1.667 psi (.113 bar) per °C. Above 25° C.
Sensor rating:	NEMA 4X (IP65)
Sensor Material:	FST-211/-221/-321/-323: PP-PPS
	FST-212/-222/-322/-324: PVDF
Cable jacket mat.:	FST-211/-221/-321/-323: PP
	FST-212/-222/-322/-324: PFA
Cable type:	4-conductor, #22 AWG (shielded)
Cable length:	10’ (3m)
Process mount:	3/4" NPT (3/4” G/Rp)
Mount. Gasket:	FKM (G version only)
Classification:	General purpose
CE compliance:	EN 61326 EMC
	EN 61010-1 safety

⚠ **Make a Fail-Safe System:** Design a fail-safe system that accommodates the possibility of switch and/or power failure. OMEGA ENGINEERING recommends the use of redundant backup systems and alarms in addition to the primary system. Adding a redundant alarm switch to the system is a cost effective means to prevent costly run-dry issues.

DIMENSIONS	Step Three

Long Sensor (FST-221/-222/-323/-324)

Short Sensor (FST-211/-212/-321/-322)

Configurations (Liquid Flow Switches):

Part Number	Length	Material (body)	Material (cable)	Thread (inside x outside)
FST-211-SPST	Short (3”)	PP-PPS	Polypropylene	¾” NPT x ¾” NPT
FST-212-SPST	Short (3”)	PVDF	PFA	¾” NPT x ¾” NPT
FST-221-SPST	Long (4.5”)	PP-PPS	Polypropylene	¾” NPT x ¾” NPT
FST-222-SPST	Long (4.5”)	PVDF	PFA	¾” NPT x ¾” NPT

Configurations (Gas Flow Switches):

Part Number	Length	Material (body)	Material (cable)	Thread (inside x outside)
FST-321-SPST	Short (3”)	PP-PPS	Polypropylene	¾” NPT x ¾” NPT
FST-322-SPST	Short (3”)	PVDF	PFA	¾” NPT x ¾” NPT
FST-323-SPST	Long (4.5”)	PP-PPS	Polypropylene	¾” NPT x ¾” NPT
FST-324-SPST	Long (4.5”)	PVDF	PFA	¾” NPT x ¾” NPT

Note: *The above products ship with a standard 10’ cable length. Adding “ -25” to the end of the part number indicates that the product has a 25’ cable length (ex. FST-211-SPST-25). Adding “ -50” to the end of the part number indicates that the product has a 50’ cable length (ex. FST-321-SPST-50).*

SAFETY PRECAUTIONS	Step Four

About this Manual: PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on all models of Omega Engineering Thermal Dispersion Flow Switches: FST-200 and FST-300 series. Please refer to the part number located on the switch label to verify the exact model which you have purchased.

User's Responsibility for safety: Omega Engineering manufactures a wide range of flow switches and technologies, while each of these sensors is designed to operate in a wide variety of applications; it is the user's responsibility to select a sensor model that is appropriate for the application, install it properly, perform tests of the installed system, and maintain all components. The failure to do so could result in property damage or serious injury.

Proper Installation and Handling: Because this is an eclectically operated device, only properly trained staff should install and/or repair this product. Use a proper sealant with all installations. ***Note:*** *Always install the 3/4" FKM gasket with all versions of Flow switches with metric threads. The G threaded version will not seal unless the gasket is properly installed.* Never over tighten the sensor within the fitting, beyond a maximum of 80 inch-pounds torque. Always check for leaks prior to system start-up.

Material Compatibility: The FST-200 and FST-300 series sensors are available in two different wetted materials. Models FST-211/-221/-321/-323 are made of Polypropylene (PP) with PPS tips. Models FST-212/-222/-322/-324 are made of Polyvinylidene Fluoride (PVDF). Make sure that the model you have selected is compatible with the application liquid. To determine the chemical compatibility between the sensor and its application liquids, refer to an industry reference such as the Compass Corrosion.

Wiring and Electrical: The supply voltage used to power the sensor should never exceed a maximum of 36 volts DC. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.

Flammable, Explosive and Hazardous Applications: DO NOT USE THE FST-200 or FST-300 SERIES GENERAL PURPOSE FLOW SWITCHES IN HAZAROUS LOCATIONS.

Warning

- *The rating for the relay is 60 VA, 1Amp max.*
- *Omega Engineering's Thermal Dispersion flow switches are not recommendable for use with electrically charged application liquids. For most reliable operation, the liquid being measured may need to be electrically grounded.*
- *The sensing tip of the sensor must always be submersed in the liquid and never exposed to air.*
- *The liquid temperature must remain constant and not change throughout the process.*

Technology: The Thermal Dispersion flow switches measure liquid or gas temperature to determine changes in flow velocity. As fluid flows across the sensing tips, the temperature is reduced proportionately as a function of the flow rate. When a temperature or velocity shift reaches the user defined set point, the switch changes state indicating the appropriate flow condition (flow of no-flow).

OMEGA ENGINEERING's sophisticated electronics convert the temperature shift into a signal which indicates whether a flow or no-flow condition occurs. Depending on how the sensor is wired, this signal may be wired for normally open or normally closed circuits.

OMEGA ENGINEERING's Thermal Dispersion flow switches have no moving parts to clog or foul, making them suitable for a verity of applications, including non-coating and non-scaling liquids. The FST-200 series directly measure mass flow and can operate over board range of liquids from 0.4 to 1.2 specific gravity and 1 to 300 cp.

Initializing Sequence for FST-200 series: When the flow switch is powered up while submersed, the FST-200 series will immediately indicate flow before switching to its correct state. A time delay may be used to eliminate the initialization sequence. Omega Engineering's thermal dispersion relay controllers feature a 0 to 60 second time delay for your convenience.

Set Points: The FST-200 series liquid flow switch set point is factory calibrated to 0.2 fps and the FST-300 gas flow switch are set to 10 fps. To convert feet/sec to GPM, please refer to the chart below.

FST-200 Series
Flow Rate vs. Velocity
(gpm vs. fps)

FST-300 Series
Flow Rate vs. Velocity
(scfm vs. fps)

The FST-200 series flow switch must always be in contact with the liquid being measured. The FST-300 series flow switch must never be submersed in liquid. Both flow switches feature a 3/4" NPT threads which will allow it to be used with various types of fittings. Be sure to check the insertion depth of the flow switch in the fitting after it is installed. See the diagram to the right for the recommended insertion depth.

- The two tip of the sensor are to be perpendicular to the flow (as seen to the right). Never mount the tips with one in from t of the other.

When using any type of fitting, the orientation as well as the insertion depth of the flow switch in the pipe is critical. See the diagram to the right for the recommended orientation.

⚠ Warning ⚠

- ⚠ The flow switch tips have a thin plastic wall which may be damaged if dropped or installed improperly.
- ⚠ The FST-200 series flow switch is designed for use in liquid. For best results, avoid installing the FST-200 series where bubbles are present or where the tips of the switch may be out of the liquid.
- ⚠ The FST-300 series flow switch is designed for us in gas applications. For best results, avoid installing the FST-300 series where it may be submersed in liquid.
- ⚠ Always install the FKM gasket with all versions of the model FST-212/-222/-322/-324. The G threaded version will not seal unless the gasket is properly installed.
- ⚠ The two temperature probes (tips) must always be perpendicular to the flow (see the flow at the same time).

Supply Voltage: The supply voltage to the Thermal Dispersion flow switch should never exceed a minimum output of 14 VDC or maximum output of 36 VDC.

Required Cable Length: Determine the length of the cable required between the Thermal Dispersion flow switch and its point of termination. Allow enough slack to ensure the easy installation, removal and/or maintenance of the sensor. The cable length may be extended up to a maximum of 1000 ft, using a well-insulated 14 to 20 gauge shielded four conductor cable.

Wire Stripping: Using a 10 gauge wire stripper, carefully remove the outer layer of insulation from the last 1-1/4" of the sensor's cable. Unwrap and discard the exposed foil shield from around the signal wires, leaving the drain wire attached if desired. With a 20 gauge wire stripper, remove the last 1/4" of the colored insulation from the signal wires.

Signal Output (Relay Switching):

Allows the sensor to switch a small load on or off directly, using an internal relay rated below 60 VA. The NO/NC status is set by the polarity of the voltage feeding the red and black wires. The green wire is the common for the relay and the white wire is the NO or NC, depending on the polarity of red and black.

Normally Open Wiring:

Wiring to an Omega Engineering Controller:

LVCN-131/-141 Series Controller

FLCN-100 Series Controller

Wiring the Relay Output: The Flow switch relay output can be wired as a dry contact to a VDC or VAC power source. The flow switch does require 14-36 VDC power to operate the sensor and switch the relay. All installations below identify a dry switch state as the normal position of the relay.

Switching a Normally Open DC Load (Open during Flow, Closed during No-Flow):

The Red wire connects to Positive (+) of the power supply and the Black wire connects to Negative (-). The LOAD can be attached to either the Green or White wires. Complete the circuit by connecting the Green to (+) VDC power or White to (-) VDC power (see illustration to the right).

Switching a Normally Closed DC Load (Closed during Flow, Open during No-Flow):

The Black wire connects to positive (+) of the power supply and the Red wire connects to Negative (-). The Load can be attached to either the Green or White wires. Complete the circuit by connecting the Green to (+) VDC power or White to (-) VDC power (see illustration to the right).

Switching a Normally Open AC Load (Open during Flow, Closed during No-Flow):

The Red wire connects to Positive (+) of the DC power supply and the Black wire connects to Negative (-). The LOAD can be attached to the Green wire and the Hot of the VAC power. Connect the white to the Neutral of the VAC power (see illustration to the right). Low voltage VAC is less than 36 VAC.

Switching a Normally Closed AC Load (Closed during Flow, Open during No-Flow):

The Black wire connects to Positive (+) of the DC power supply and the Red wire connects to Negative (-). The LOAD can be attached to the Green wire and the Hot of the VAC power. Connect the White to the Neutral of the VAC power (see illustration to the right). Low voltage VAC is less than 36 VAC.

For all Sensor Wiring diagrams above:

Sensor Power: Red and Black Wires (36 VDC Max.)

Relay Rating: Green and White Wires (60VA, 1A Max.)

Wiring as a P-Channel or N-Channel output: The Flow switch can be substituted for either a P-Channel (PNP, Sourcing) output or N-Channel (NPN, sinking) output.

Normally Open DC Load as a P-Channel Output (Open during Flow, Closed during No-Flow):

To wire as a NO P-Channel output follow the directions below. The Red Wire connects to Positive (+) of the power supply and the Black wire connects to Negative (-). The Green wire is jumping to the Red wire while the White wire is connected to the LOAD. Jumper the LOAD back to the Negative (-) to complete the circuit.

Normally Closed DC Load as a P-Channel Output (Closed during Flow, Open during No-Flow):

To wire as a NC P-Channel output, follow the directions below. The Black wire connects to Positive (+) of the power supply and the Red wire connects to Negative (-). The Green wire is jumping to the Black wire while the White wire is connected to the LOAD. Jumper the LOAD back to the Negative (-) to complete the circuit.

Normally Open DC Load as a N-Channel Output (Open during Flow, Closed during No-Flow):

To wire as a NO N-Channel output, follow the directions below. The Red wire connects to Positive (+) of the power supply and the Black wire connects to Negative (-). The white wire is jumping to the Black wire while the Green wire is connected to the LOAD. Jumper the LOAD back to the Positive (+) to complete the circuit.

Normally Closed DC Load as a N-Channel Output (Closed during Flow, Open during No-Flow):

To wire as a NC N-Channel output, follow the directions below. The Black wire connects to Positive (+) of the directions below. The Black Wire connects to Negative (-). The white wire is jumping to the Red wire while the White wire is connected to the LOAD. Jumper the LOAD back to Positive (+) to complete the circuit.

For all Sensor Wiring diagrams above:

Sensor Power: Red and Black Wires (36 VDC Max.)

Relay Rating: Green and White Wires (60VA, 1A Max.)

CALIBRATION	Step Eight

Set Point: If the preset factory calibration is not adequate for your application, follow the calibration steps listed below.

Note: The switch's internal LED will be on when the switch detects no-flow and will off when the switch detects flow, regardless of the polarity of the Red and Black wires. Reversing the Red and Black wires will reverse the polarity of the relay switch, but not the internal LED.

1. Install the fitting and flow switch as described in the Installation section of this manual. Turn the flow switch and controller power on and adjust the flow rate to the application setting. If the medium to be sensed is likely to be subject to any temperature variation, the flow switch should be set as the highest normal temperature likely to be encountered.
2. Locate the potentiometer knob at the top of the flow switch. The red LED is visible through the potentiometer. The adjustment is a single turn 270° potentiometer. The initial response time of the flow switch after adjustment is 1 to 10 seconds. Adjust the potentiometer in slow increments and wait for the response.
   a. LED is ON - If the LED is on, slowly adjust the potentiometer counter-clockwise, with a small flat head screwdriver until the LED turn off.
   b. LED is OFF - If the LED is off, slowly adjust the potentiometer clockwise. with a small flat head screwdriver until the light turns on.
3. Adjust the potentiometer back and forth where the LED is switching, eventually settling for where the LED is OFF (this is the low flow state for the switch).
   a. If the flow is increased, the LED will remain OFF indicating a flow condition
   b. If the flow is decrease, the LED will turn ON indicating a no-flow condition.
4. Verify that the new calibration is correct by lowering the system flow rate below the set point and check to see that the red LED turns on. Then increase the flow rate above the set point and verify that the red LED turns off accordingly.

FST-200 Series Flow Switch (Liquid Only)

Potentiometer Location

FST-300 Flow Switch (Gas Only)

MAINTENANCE Step Nine

General: The Flow switch requires no periodic maintenance except to clean off any deposits or scaling from the sensor tip as necessary. It is the responsibility of the user to determine the appropriate maintenance schedule, based on the specific characteristics of the application liquids.

Cleaning Procedure:

1. **Power:** Make sure that all power to the sensor, controller and/or power supply is completely disconnected.
2. **Sensor Removal:** ***Make sure that the flow is off and the pressure is down prior to removing the Flow switch.*** Carefully, remove the sensor from the installation. Replace the sensor with a 3/4" NPT plug to insure that the liquid does not leak out during this procedure. ***Do not re-install the Flow switch if the threads are damaged.***
3. **Cleaning the sensor:** Use a soft bristle brush and mild detergent, carefully wash the Thermal Dispersion flow switch. Do not use harsh abrasives such as steel wool or sandpaper, which might damage the surface sensor. Do not use incompatible solvents which may damage the surface sensor. Do not use incompatible solvents which may damage the sensor's PP/Ryton or PVDF plastic body.
4. **Sensor Installation:** Follow the appropriate steps of installation as outlined in the installation section of this manual.

Testing the Sensor (FST-200 Series Only):

1. **Immersing the switch:** Place the switch in a cup of water. Make sure the tips are submersed in the water.
2. **Power:** Turn on power to the switch with Red to (+) and Black to (-)**.** You can reverse the polarity if desired.
3. **No-Flow/Flow Test:** With the switch setting still in the cup, wait until the Red LED turns ON (no-flow condition).
   a. Swirl the switch in the cup and wait until the Red LED turn OFF (flow condition).
   b. Stop swirling the sensor and let it rest in the cup waiting for the Red LED to turn ON again (no-flow condition).
   c. Repeat the above two steps.
4. **Relay Test:** Connect a multimeter (set to read Ohms) to the White and Green Wires. Perform the above No-Flow/Flow test with the multimeter connect to observe the actuation of the relay.
   a. With Red to (+) and Black to (-), the multimeter will read a small resistance during no-flow (closed relay) and OL during a flow condition (open relay).
   b. Reverse Polarity [Red to (-) and Black to (+)] to see the multimeter read OL during a no-flow state (open relay) and a small resistance during a flow condition (closed relay).

The No-Flow/Flow test determines if the switch is capable of sensing the changes between no-flow and flow. The Relay test determines the ability of the relay to switch between a no-flow and flow condition. This is the basic test to determine functionality of the sensor.

Testing the Sensor (FST-300 Series Only):

1. **Creating a No-Flow Test Point:** The purpose of this step is to create a no-flow state for the sensor to be tested against. Since this is a low flow switch, even a buildings HVAC system can create a flow that the sensor can read.
    - **a.** Place the switch on a table and place an empty cup over the sensing tips.
    - **b.** The cup will act like a shield to protect the sensor from air flow.
2. **Power:** Turn on power to the switch with Red to (+) and Black to (-)**.** You can reverse the polarity if desired.
3. **No-Flow/Flow Test:** With the switch setting still under the cup, wait until the Red LED turns ON (no-flow condition).
    - a. Remove the cup and move the sensor in air and observe when the Red LED turn OFF (flow condition).
    - b. Place the sensor on the table and place the cup over the sensor and let it rest waiting for the Red LED to turn ON again (no-flow condition).
    - **c.** Repeat the above two steps.
4. **Relay Test:** Connect a multimeter (set to read Ohms) to the White and Green Wires. Perform the above No-Flow/Flow test with the multimeter connect to observe the actuation of the relay.
    - a. With Red to (+) and Black to (-), the multimeter will read a small resistance during no-flow (closed relay) and OL during a flow condition (open relay).
    - b. Reverse Polarity [Red to (-) and Black to (+)] to see the multimeter read OL during a no-flow state (open relay) and a small resistance during a flow condition (closed relay).

The No-Flow/Flow test determines if the switch is capable of sensing the changes between no-flow and flow. The Relay test determines the ability of the relay to switch between a no-flow and flow condition. This is the basic test to determine functionality of the sensor.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

M-3948/0413

Rosemount 2110 Compact Vibrating Fork Liquid Level Switch

- *Function virtually unaffected by flow, turbulence, bubbles, foam, vibration, solids content, coating, properties of the liquid, and product variations*
- *No need for calibration and requires minimum installation procedures*
- *Polarity insensitive and short circuit protection*
- *Industry standard plug/socket connection*
- *No moving parts or crevices means virtually no maintenance*
- *Electronic, self-checking, and condition monitoring - Heartbeat LED gives status and health information*
- *Magnetic test point makes functional test easy*
- *Compact design, small in size and weight*
- *"Fast Drip" Fork Design gives quicker response time especially with viscous liquids*
- *Hygienic connections*

DIBt

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Reliable Performance...In Challenging Applications

Threaded Process Connection

Tri-Clamp Process Connection

Compact And Lightweight

'Fast Drip' Forks

MEASUREMENT PRINCIPLE

The Rosemount 2110 is designed using the principle of a tuning fork. A piezo-electric crystal oscillates the forks at their natural frequency. Changes to this frequency are continuously monitored. The frequency of the vibrating fork sensor changes depending on the medium in which it is immersed. The denser the liquid, the lower the frequency.

When used as a **low level alarm**, the liquid in the tank or pipe drains down past the fork, causing a change of natural frequency that is detected by the electronics and switches the output state.

When the 2110 is used as a **high level alarm**, the liquid rises in the tank or pipe, making contact with the fork which then causes the output state to switch.

KEY FEATURES AND BENEFITS

- Virtually unaffected by turbulence, foam, vibration, solids content, coating, or liquid properties
- Stainless steel housing and plug/socket connection for the fast fit, high volume user
- Compact and lightweight design for side or top mounting
- The industry standard DIN 43650 plug/socket is used for a fast connection. The polarity insensitivity and short circuit protection make electrical hook-up safe and easy
- The 2110 is designed for operation in temperatures from –40 to 302 °F (–40 to 150 °C)
- The 'heartbeat' LED gives status and health information on the 2110
- 'Fast Drip' fork design gives quicker response time, especially with viscous liquids
- Rapid wet-to-dry time for highly responsive switching
- Fork shape is optimized for hand polishing to meet hygienic requirements
- No moving parts or crevices for virtually no maintenance

Fit and Forget

- Once installed, the 2110 is ready to go.
  It needs no calibration and requires minimum installation
- The ‘heartbeat’ LED gives an instant visual indication that the unit is operational
- Functional testing of the instrument and system is easy with a magnetic test point
- You can install, and forget it

Superior Performance

- Functionality is virtually unaffected by flow, turbulence, bubbles, foam, or vibration
- The ‘Fast Drip’ design allows the liquid to be quickly drawn away from the fork tip, making the 2110 quicker and more responsive in high density or viscous liquid applications
- With a user-selectable time delay feature, the risk of false switching is minimized in turbulent or splashing applications

APPLICATIONS

- Overfill protection
- High and low level alarms
- Leak detection
- Run dry or pump protection
- Pump control or limit detection
- Hygienic applications

Overfill Protection

High And Low Level Alarm

Leak Detection

Pump Protection

Rosemount 2110
Compact Vibrating Fork Liquid Level Switch

2110 Level Switch

Rosemount 2110 capabilities include:

- Rugged stainless steel body and fork, the ideal choice for OEM applications
- Compact design, small and lightweight, perfect for small tank or pipe installations
- Short fork or semi-extended lengths
- Direct load switching or PNP/PLC electronics
- Safe area only

Additional Information

Specifications: page 5
Certifications: page 6
Dimensions: page 7

TABLE 1. 2110 Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	Product Description	
2110	Compact Vibrating Fork Liquid Level Switch	
Electronic Type		
Standard		**Standard**
0	Direct load switching with plug connection (2 wire) 21 to 264 Vac 50/60Hz, 21 to 264 Vdc	★
1	PNP/PLC low voltage switching with plug connection 18 to 60 Vdc	★
Process Connection Size / Type		
Standard		**Standard**
0A	3/4-in. BSPT (R) thread	★
1A	1-in. BSPT (R) thread	★
0D	3/4-in. NPT thread	★
2R	2-in. (51 mm) Tri-clamp	★
1B	1-in. BSPP (G) thread	★
1L	1-in. BSPP (G) Semi-extended 4.6 in. (116 mm)	★
Product Certificates		
Standard		**Standard**
NA	No hazardous locations certifications (safe area use only)	★
U1	DIBt/WHG Overfill protection	★
OPTIONS		
Calibration Data Certificate		
Standard		**Standard**
Q4	Certificate of functional test	★
Tag Plate		
Standard		**Standard**
ST	Tag plate SST engraved plate (maximum 16 digits)	★
WT	Tag plate laminated paper (maximum 40 digits)	★
Typical Model Number: 2110 0 2R NA		

TABLE 2. Spare Parts and Accessories

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Spares and Accessories		
Standard		**Standard**
02100-1000-0001	Seal for 1-in. BSPP (G1A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder	★
02100-1010-0001	Hygienic adaptor boss for 1-in. BSPP model. Material: 316 SST fitting. Fluorocarbon (FPM/FKM) O-ring	★
02100-1020-0001	Hygienic mounting kit for 2-in. (51 mm) Tri-clamp model. Includes vessel fitting, clamp ring, and seal. Material: 316 SST and NBR Nitrile	★
02100-1030-0001	Telescopic test magnet	★

Specifications

PHYSICAL

Product
Rosemount 2110 Compact Liquid Level Switch

Measuring principle
Vibrating Fork

Applications
Most liquids including coating liquids, aerated liquids, and slurries

Mechanical

Process Material
316L Stainless Steel (1.4404)

For Tri-Clamp connection, hand polished to better than 0.8 µm. Gasket material for 1 in. BSPP (G1) is Non-asbestos BS7531 Grade X carbon fiber with rubber binder.

Housing Materials
Body: 304 SST with polyester label
LED window:
Flame retardant Polyamide (Pa12) UL94 V2
Plug: Polyamide glass reinforced
Plug seals: Nitrile butadiene rubber

Mounting
- 3/4-in. BSPT (R) or NPT
- 1-in. BSPT (R) or BSPP (G) thread, or
- Hygienic 2-in. (51 mm) Tri-clamp fitting

Dimensional Drawings
See “Dimensional Drawing” on page 7

Ingress of Protection Rating
IP66/67 to EN60529

PERFORMANCE

Hysteresis (water)
±0.039-in. (± 1 mm) nominal.

Switching Point (water)
0.5 in. (13 mm) from fork tip if mounted vertically.

0.5 in. (13 mm) from the fork edge if mounted horizontally.

The switch point varies with different liquid densities.

FUNCTIONAL

Maximum Operating Pressure
(The final rating depends on the process connection)

Threaded Connection
See Figure 1

Hygienic Connection
435 psig (30 barg)

Figure 1. Process Pressure

Temperature
See Figure 2 for the maximum and minimum operating temperatures.

Figure 2. Temperature

Liquid Density
Minimum 37.5 lb/ft^3 (600 kg/m^3)

Liquid Viscosity Range
0.2 to 10000 cP (centiPoise)

Solids Content and Coating
Maximum recommended diameter of solid particles in the liquid is 0.2 in. (5 mm).
For coating product, avoid ‘bridging’ of forks.

Switching Delay
1 second dry-to-wet or wet-to-dry

CIP (Clean In Place) Cleaning
Withstands steam cleaning routines up to 302 °F (150 °C)

Electrical

Switching Mode
User selectable (Dry=on or Wet=on) by selecting plug wiring

Cable Connection
Via 4-way plug provided (DIN43650).
Max. conductor size is 15AWG.
4-position orientation (90/180/270/360 deg).

Conductor Size
Maximum 0.06 in.^{2} (1,5 mm^2)

Cable Gland
PG9 provided. Cable diameter 0.24 to 0.31 in. (6 to 8 mm)

Protection
Polarity insensitive. Over-current, short circuit, and load-missing protection. Surge protection to IEC61326.

Grounding
The 2110 should always be grounded either through the terminals or using the external ground connection provided.

Direct Load Switching (Electronics Type Code 0)	
Operating Voltage	21 to 264 Vac (50 to 60 Hz)/dc
Maximum switched load	500 mA
Maximum peak load	5 A for 40 ms max.
Minimum switched load	20 mA continuous
Voltage drop	6.5 V @ 24 Vdc / 5 V @ 240 Vac
Current draw (load off)	<3.0 mA continuous

PNP Switching (Electronics Type Code 1)	
Operating Voltage	18 to 60 Vdc
Maximum switched load	500 mA
Maximum peak load	5 A for 40 ms max.
Voltage drop	<3 V
Supply Current	3 mA nominal
Output current (load off)	<0.5 mA

Product Certifications

L.V. Directive
EN61010-1 Pollution degree 2,
Category II (264V max),
Pollution degree 2, Category III (150 V maximum)

Electro Magnetic Compatibility (EMC) Directive
EN61326

Overfill Protection
If required, select Product Certificates code U1 for DIBt/WHG overfill protection.
The approval number is Z-65.11-236.

Canadian Registration Number (CRN)
The CRN is 0F04227.2C for model numbers with a NPT threaded process connection selected.

Dimensional Drawing

Process Connections	A	B	C	D
3/4-in. BSPT (R)	2.72 (69)	1.97 (50)	7.40 (188)	N/A
3/4-in. NPT	2.72 (69)	1.97 (50)	7.40 (188)	N/A
1-in. BSPT (R)	2.72 (69)	1.97 (50)	7.40 (188)	N/A
1-in. BSPP (G)	3.07 (78)	2.36 (60)	7.91 (201)	N/A
2-in. (51 mm) Tri-Clamp	2.72 (69)	1.97 (50)	7.40 (188)	2.52 (64)
1-in. Semi-extended	4.57 (116)	3.86 (98)	9.41 (239)	N/A

Rosemount Level Solutions

Emerson provides a complete range of Rosemount products for level measurement applications.

Vibrating Fork Switches – Point Level Detection

For high and low alarms, overfill protection, pump control, including wide pressure and temperature requirements, and hygienic applications. Flexible mounting. Immune to changing process conditions and suitable for most liquids.
The product line consists of:

- Rosemount 2160 Wireless
- Rosemount 2130 Enhanced
- Rosemount 2120 Full-featured
- Rosemount 2110 Compact

Differential Pressure – Level or Interface Measurement

Flexible mounting for liquid tank levels, including those with wide temperature and pressure requirements. Can be isolated by valves. Unaffected by: vapor space changes, surface conditions, foam, corrosive fluids, internal tank equipment. Optimize performance with direct mount, Tuned-System Assemblies:

- Rosemount DP Level Transmitters and Remote Seals
- Rosemount 3051S_L, 3051L, and 2051L Liquid Level Transmitters

Ultrasonic – Level Measurement

Top mounted, non-contacting for simple tank and open air level measurements. Unaffected by fluid properties such as: density, viscosity, dirty coating, and corrosiveness. Appropriate for routine applications outside of explosion proof areas.
The product line consists of:

- Rosemount 3100 Series Ultrasonic Process Level Transmitters

Guided Wave Radar – Level and Interface Measurement

Top mounted, direct level and interface measurement of liquids or solids, including those with wide temperature and pressure requirements. Unaffected by changing process conditions. Good fit for small spaces and easy swap for older technologies.
The product line consists of:

- Rosemount 5300 Series – Accurate, superior performance transmitter in most applications including process vessels and control
- Rosemount 3300 Series – Versatile and easy-to-use transmitter in most liquid storage and monitoring applications

Non-contacting Radar – Level Measurement

Top mounted, direct level measurement for liquids or solids, including those with wide temperature and pressure requirements. Can be isolated by valves. Unaffected by changing process conditions. Good for dirty, coating, and corrosive applications.
The product line consists of:

- Rosemount 5400 Series – Accurate, superior performance 2-wire transmitters for most liquid level applications and process conditions
- Rosemount 5600 Series – 4-wire transmitters with maximum sensitivity and performance for solids, challenging reactors, rapid level changes, and excessive process conditions

Chambers for Process Level Instrumentation

- Rosemount 9901 – High quality chambers for external mounting of level measurement and control instrumentation on process vessels

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Emerson Process Management
Rosemount Measurement
8200 Market Boulevard
Chanhassen, MN 55317 USA
Tel (USA) 1 800 999 9307
Tel (International) +1 952 906 8888
Fax +1 952 949 7001
www.rosemount.com

Emerson Process Management
Blegistrasse 23
P.O. Box 1046
CH 6341 Baar
Switzerland
Tel +41 (0) 41 768 6111
Fax +41 (0) 41 768 6300

Emerson FZE
P.O. Box 17033
Jebel Ali Free Zone
Dubai UAE
Tel +971 4 811 8100
Fax +971 4 886 5465

Emerson Process Management
Asia Pacific Pte Ltd
1 Pandan Crescent
Singapore 128461
Tel +65 6777 8211
Fax +65 6777 0947
Service Support Hotline: +65 6770 8711
Email: Enquiries@AP.EmersonProcess.com

EMERSON
Process Management

THERMAL DISPERSION FLOW SWITCHES FOR LIQUIDS

FST-200 Series

- High Reliability—No Moving Parts
- Very Low Flow Detection–Down to 0.04 FPS Liquids
- Use in ⅛ to 12" Pipe or Tubing
- SPST Relay Standard
- Excellent for Pump and Valve Monitoring of Critical Flows

OMEGA® FST-200 Series flow switches use thermal dispersion technology to create a very accurate and economical method of sensing flow. Monitor fluids from 0.4 to 1.2 specific gravity, 1 to 300 cp, and pulsating flow from 10 to 100 pulses per minute. The sensors incorporate two temperature probes, one of which is heated. The flow of liquid reduces the temperature of the heated probe, decreasing the temperature differential with the non-heated probe. OMEGA's LVCN Series of controllers can easily be interfaced to perform a variety of control functions.

SPECIFICATIONS

Range: 0.04 to 3 fps (liquids)
Accuracy: ±5% of setpoint at constant temperature and flowrate
Response Time: 10 sec after initial 30 sec warm up
Setpoint Drift With Fluid Temperature: 0.5% per °C
Voltage Input: 12 to 36 Vdc @ 70 mA
Contact Output Mode: Selectable, NO or NC states
Fluid Temperature: 0 to 60°C (32 to 140°F)
Maximum Fluid Pressure: PP or PVDF: 150 psi @ 25°C (77°F) derated @ 1.667 psi per °C above 25°C (77°F)
Wetted Materials: PP and PVDF
Cable Specifications: 3 m (10')
Maximum Cable Length: 305 m (1000')
Dimensions: 76.2 or 114.3 L x 26.7 mm diameter (3.0 or 4.5 x 1.05")

To Order

Model No.	Description	Material	Size	Use With Pipe Size
FST-211-SPST	Thermal dispersion flow switch	PP/ PVDF	3.0 x ¾ NPT	¾ to 1½"
FST-212-SPST	Thermal dispersion flow switch	PVDF	3.0 x ¾ NPT	¾ to 1½"
FST-221-SPST	Thermal dispersion flow switch	PP/ PVDF	4.5 x ¾ NPT	2 to 12"
FST-222-SPST	Thermal dispersion flow switch	PVDF	4.5 x ¾ NPT	2 to 12"

Flow Switch Fittings For Use with 76 mm (3") Sensor Only (Also For Pulsating Flow Applications)

Model No.	Wetted Material	Range (GPM)	Use With Pipe/Tube ID
FT-51	PP	0.05 to 1.53	⅛ to ½"
FT-52	PVDF	0.05 to 1.53	⅛ to ½"

Comes complete with operator's manual.
*Two extended cable lengths available: for 7.62 m (25') add suffix **"-25"** for PP/PVDF, or PVDF; for 15.24 m (50') add suffix **"-50"** for PP/PVDF or PVDF, for additional cost.*
***Note:** Sizes above ½" fit into ¾ NPT fitting adaptor.*
***Ordering Examples: FST-211-SPST,** flow switch, 3.0 x ¾ NPT size, plus **FT-51,** fitting.*
***FST-221-SPST**, flow switch, 4.5 x ¾ NPT.*

ABO valve

ABsOlute flow control

SERIES 900

// PN 6/10/16/Class 150
// DN 32 - 1600 (1“ ¼ - 64“)
// Industrial applications
// Water, chemicals, gas
// Oil & gas, air

CE

DVGW

Lloyd's Register

TÜV

INTERFLANGES BUTTERFLY VALVES

WWW.ABOVALVE.COM

GENERAL INFORMATION

GENERAL CHARACTERISTICS

- Concentric design
- Shut-off and regulating device
- Split shaft
- Pivot fixed by pin (or screw - option) allows demounting (demountable version)
- Long neck of the body according to Heating Systems Regulation standards
- Orange epoxy painting RAL 2002 - 80 µm
- Vacuum max 0,2 bar absolute
- Movement of disc ensured by four-squared endstem
- Certificate ATEX (Group II, Category 1/2 GD TX)
- Approved for demanding GAS applications by certificate DVGW

APPLICATIONS

Butterfly valves series 900 are suited for many applications where tight shut-off is required, such as:

- Industrial Processing
- Water and Wastewater
- Dry Bulk Conveying
- Light Slurry Handling
- Paper Mills
- Food and Beverage
- HVAC (Heating, Ventilating & Air Conditioning)
- Non-mining environments and explosive atmosphere consisting of dust and gas (zones 0, 1, 20 and 21)

STANDARDS

LEAK TEST:
- EN 12266-1, Rate A
- ISO 5208, Rate A
- API 598, TAB. 5

FACE TO FACE ACC.:
- EN 558, SERIES 20
- ISO 5752, SERIES 20
- API 609, TAB. 2

TOP FLANGE:
- EN ISO 5211

CONNECTION BETWEEN FLANGES:
- EN 1092-1
- DIN 2631
- ASME B16.5

WORKING STANDARD:
- EN 593 + A1

TYPE DESIGNATION

9 2 4 B

Version of body
B = wafer
T = lug
F = double flange

Material of disc
0 – Brass 2.0402
1 – Aluminium bronze 2.0966
2 – Stainless steel 1.4308 (CF8)*
3 – Ductile iron 0.7040 (GGG40)*
4 – Stainless steel 1.4408 (CF8M)*
5 – HASTELLOY
6 – Stainless steel 1.4539 (Uranus B6)
7 – Titanium
* Halar + Rilsan Coating optional

Material of seat
1 – NBR
2 – EPDM
3 – Carboxylic NBR
4 – VITON (FPM)
5 – Silicone Steam (MVQ)
6 – Silicone (VMQ)
7 – Epichlorohydrin
8 – HYPALON® (CSM)
9 - other variant

Series name
Series 900

Models

Wafer type B

Lug type T

Double flanged type F for DN 700 – DN 1600

PRODUCT QUALITY AND CONTROL

- ABO production facilities are certified in accordance to ISO 9001 quality system
- Test procedures are established according to: EN 12266-1, ISO 5208, API 598, ANSI/FCI 70-2
- Manufacture according to the requirements of the European Directive 97/23/CE – Equipment under pressure (Category III, modul B)
- All ABO valves pass pressure tests to 110% of rated pressure to ensure bubble tight shutoff
- All actuators are calibrated and cycle tested before shipment
- Material Traceability Rule – Certification is provided for all supplied valves as per customer's request
- Positive Material Identification – All materials are subjected to PMI testing in order to verify Material Traceability Certificate
- Certificates - Complete list of certificates can be found on www.abovalve.com

DESIGN BENEFITS

1) INTERNATIONAL STANDARD COMPATIBILITY

Top flange according to Standard ISO 5211 enables direct mounting of manual operators and power actuators. Longer necks of ABO butterfly valves result in insulation of ISO top flange (protection of mounted actuator) and meeting Heating Systems Regulation standards.

2) BLOW-OUT PROOF STEM SYSTEM

No up-movement of stem is ensured by securing pin in the body neck.

5) 2-PIECED STEM SYSTEM

Splitted steam and pivot system and highly profiled disc ensure high Kv/Cv and lower pressure drop.

3) SEAT DESIGN

Seat is anchored in the body (groove and tongue design) and its movement is ensured by four-squared endstem.

4) DEMOUNTABLE DESIGN

Pivot fitted by pin or screw according to customer's request allows demounting.

MATERIALS & TECHNICAL INFORMATION

DRAWING & MATERIALS

Item	Name	Material
1	Body	Ductile iron 0.7040 (GGG40) epoxy coated Carbon steel 1.0446 (A216 WCB) Low carbon content steel 1.1156 (A352 LCC) Stainless steel 1.4408 (CF8M)
2	Disc	0 – Brass 2.0402 1 – Aluminium bronze 2.0966 2 – Stainless steel 1.4308 (CF8) 3 – Ductile iron 0.7040 (GGG40) 4 – Stainless steel 1.4408 (CF8M) 5 – HASTELLOY 6 – Stainless steel 1.4539 (Uranus B6) 7 – Titanium
3	Seat	1 - NBR - 10°C + 100°C 2 - EPDM - 25°C + 125°C 3 - Carboxylic NBR - 10°C + 100°C 4 - VITON (FPM) - 15°C + 150°C* 5 - Silicone Steam (MVQ) - 30°C + 140°C 6 - Silicone (VMQ) - 30°C + 150°C 7 - Epichlorohydrin - 30°C + 70°C 8 - HYPALON® (CSM) - 25°C + 120°C 9 - NBR 70-AG - 10°C + 60°C - NBR conduct - 10°C + 80°C
4	Shaft	Stainless steel 1.4021 (AISI 420)
5	Pivot	Stainless steel 1.4021 (AISI 420)
6	Bushing	Delrin (up to DN 300) Brass (from DN 350)
7	Distance ring	Stainless steel
8	Distance ring	Stainless steel
9	Pin	Stainless steel 1.4401 (AISI 316)
10	Retaining screw	Stainless steel
11	Shaft O-ring	NBR, EPDM, VITON is an option
12	Pivot O-ring	NBR, EPDM, VITON is an option

Execution in other material types can be provided upon request. Choice of the seat and disc materials for various media will be recommended upon specific enquiry. Max. temperatures for each material of seat are accepted only for a specific medium and short time exposure.

* Max. temperature for water services only up to 80 °C.

INSTALLATION BETWEEN FLANGES (DN 32-600)

Vers.	PN / DN	32/40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
B	PN 6											●	●	●	●	●
	PN10															
	PN16													●		
	Class 150											●	●	●	●	●
T	PN 6	●	●	●	●	●	●	●	●	●	●	●	●	X	X	X
	PN10													●	●	●
	PN16								●	●	●	●	●	●	●	●
	Class 150	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

INSTALLATION BETWEEN FLANGES (DN 700 – 1600)

Vers.	PN / DN	700	800	900	1000	1100	1200	1300	1400	1500	1600
F	PN 6	●	●	●	●	●	●	●	●	●	●
	PN 10										
	PN 16	●	●	●	●	●	●	●	●	●	●
	Class 150	●	●	●	●	●	●	●	●	●	●

	standard
●	*upon request*
X	*not suitable*

* For JIS 5K/10K, please consult with ABO.

WORKING CONDITIONS

- **Max working pressure** o DN 32 - 600: 16 bar
  o DN 700 - 1600: 10 bar (16 bar upon request)
- **Temperature range - max:** - 30°C + 150°C (- 22°F + 302°F), depends on material selection

When temperature of medium increases over + 120 °C, the max allowed pressure falls from 16 bar to 14,4 bar and from 10 bar to 9 bar

COATING

- Standard coating is orange epoxy painting RAL 2002 - 80 µm
- Based on customer's request, it is possible to modify the colour or provide higher degree of coating

ACTUATION & TORQUES

ACTUATION POSSIBILITIES

All ABO handles, manual gear operators, pneumatic and electric actuators can be mounted directly to ABO butterfly valves, thus eliminating brackets or couplings. This allows for simple installation in the field, minimizes possible misalignment and decreases overall height.

MANUAL ACTUATION: HANDLEVER

For manual actuation, ABO offers levers in carbon steel material with protective coating for excellent corrosion, abrasion and impact resistance. A lever in stainless steel material is an option. ISO top flange connection is F05 for sizes DN 50 and 65, and F07 for sizes DN 80-200, respectively. Handlever in regulating design optional.

DN 32 - 200

DN 250 - 300

Type L (only up to 6 bar)

DN	32 - 100	125	150 - 200	250	300
A	270	270	362	450	750
B	75	80	90	135	135
Weight	1,24	1,26	1,4	2,2	3,1

Dimensions mentioned in mm, weight in kg.

MANUAL GEARBOX WITH HANDWHEEL

ABO gearbox series of manual actuators combines state of art production technology, with cast iron and pressed steel construction, to provide a smooth and trouble-free operation for heavy duty on-off and throttling service of ABO valves. The rugged, cast iron body seals is weatherproof to IP65. A self-locking gearing holds the valve in the desired position. Further features include a readily accessible handwheel, adjustable stopcrew for closed position, removable splined drive bush with indexing facility and a facility to lock handwheel with padlock and chain. Gearboxes, as well as handlevers, can be supplemented with contacts for signalization of endpoints.

DN	32 – 150	200	250-300	350	400	450	500	600
A	89	89/127**	155	213	263	275	275	350
B	51	51	66	83	83	99	99	126
C	152	152/185**	272	302	334	279	279	360
D	44	44	59	70	70	96	96	118
E	101	101/138,5**	177	242	292	314	314	423
F	125	125/200*	250	350	450	450	450	600
Weight	1,6	1,6	3,7	6,6	6,6	14,5	14,5	27,2
Wheel	SR5	SR5/SR8*	SR10	R14	R18	R18	R18	R24

Dimensions mentioned in mm, weight in kg. Valid for SE Series (DN 32 - 400), M Series (DN 450 - 600).
*Optional **Acc. to handwheel choice

ACTUATORS

- PNEUMATIC ACTUATORS - ABO pneumatic actuators Series 95 are rack and pinion, opposed-piston actuators available in two versions: single acting & double acting
- ELECTRIC ACTUATORS - ABO series 97 electric actuators are designated for quarter turn operating application. Electric actuators of 24V, 230V and 400V can be installed on ABO butterfly valves.

OPERATING TORQUES UPON WORKING PRESSURE (NM)*

DN	32/40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
PMA 6 bar	6	8	15	20	38	55	70	100	150	235	480	750	1180	1380	2050
PMA 10 bar	8	10	17	25	46	70	80	125	220	290	530	1200	1550	2050	2700
PMA 16 bar	10	12	20	30	55	85	100	150	290	380	580	1650	2100	2700	3750

DN	700	800	900	1000	1200	1400	1600
PMA 10 bar	3500	4500	6000	8950	12600	18500	24400

The above mentioned torques are valid for valves with EPDM seat only, and under the condition that the working medium is liquid. While actuating the valve, the above mentioned figures should be multiplied by a coefficient of 1,2. Using a NBR seat, it is necessary to apply a coefficient of 1,8 for dimensions up to DN 300 and a coefficient of 1,32 for dimensions DN 350 and above. In case the medium is gaseous, or if it contains abrasive particles, it is necessary to apply a secondary coefficient of 1,35. If the working conditions are specific, it is recommended to discuss the selection of the actuator with the manufacturer.

DIMENSIONS DN 32 - 1600 (1"¼ - 64")

DN 32 - 600 (1"¼ - 24") PN 6/10/16/Class 150

Lug type T

Wafer type B

DN		mm	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
		inch	1"1/4	1"1/2	2"	2"1/2	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"
Version	B	A	136	136	146	153,5	163	172,5	192,5	205	234	270	310	325	365	375	482	562
	T	A															485	565
Valve dimensions		B	54	54	64	72	89	105	118	128	166	202	237	271	314	330	363	464
		C	33	33	43	46	46	52	56	56	60	68	78	78	102	114	127	154
		D	78	78	96	113	128	150	184	212	268	320	378	435	488	544	590	695
		E	110	110	115	129	174	204	234	255	319	396	465	509	590	610	682	810
Endshaft dimensions		F	25	25	25	25	25	25	25	25	25	30	30	36	36	80	80	80
		G	14						17			22	22	27	27	10	12	14
		H	-	-	-	-	-	-	-	-	-	-	-	-	-	Ø38	Ø42	Ø50
ISO TOP Flange		I	50/70		50				70			102	102	125	140	140	140	165
		J	4															
		K	7						9			10,5	10,5	14	18	18	18	23
Flange dimensions		L	-	-	70				-	-	-	-	-	-	-	175	175	210
		M	70	70	-	-	-	-	75	75	75	105	105	130	140	-	-	-
		N	8	8	8	8	8	8	9,5	9,5	14	17	17	17	21	22	25	25
Weight (kg)	Type B		1,9	1,9	2,7	3,2	3,7	4,7	6,7	8,4	13,3	22,0	29,3	46,4	69,8	83,0	112	216
	Type T		2,3	2,3	3,0	3,7	4,8	6,1	9,2	10,2	15,3	28,4	41,2	62	96,3	130	149	288
ISO Flange			F05/F07		F05				F07			F10		F12	F14			F16

DN 700 - 1600 (28" - 64") PN 10

DN	mm	700	800	900	1000	1200	1400	1600
	inch	28"	32"	36"	40"	48"	56"	64"
Version - F	A	629	666	720	800	940	1009	1150
Valve dimensions	B	537	601	656	720	844	1014	1045
	C	165	190	203	216	254	279	318
	D	940	1060	1168	1255	1485	1685	1930
Endshaft dimensions	F	95	95	130	130	150	150	180
	G	16	16	20	22	28	32	40
	H	55	55	75	85	105	120	140
	M	63	63	84	95	117	134	178
ISO TOP Flange	I	254	254	254	254	298	356	356
	J	8	8	8	8	8	8	8
	K	18	18	18	18	22	33	33
	L	300	300	300	300	350	415	415
Weight (kg)		350	580	700	850	1080	1922	2350
ISO Flange		F25	F25	F25	F25	F30	F35	F35

For version PN 16 / Class 150 upon request.

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND
INVESTMENT IN YOUR FUTURE

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30. 9. 2014

Data subject to change.

Company HQ – Czech Republic:
ABO valve, s.r.o.
Dalimilova 285/54, 783 35 Olomouc
Tel: +420 585 202 226, +420 585 224 087
Email: export@abovalve.com
www.abovalve.com

Slovakia:
ABO Slovakia, s.r.o.
Banská Bystrica
Tel: +421 484 145 633
Email: aboslovakia@aboslovakia.sk
www.aboslovakia.sk

Russia:
ABO ARMATURA Ltd.
Smolensk
Tel: +7 4812 31 28 27
Email: aboarmatura@yandex.ru
www.aboarmatura.ru

Singapore:
ABO Valve Pte. Ltd.
Singapore
Tel: +65 6383 4368
Email: lsw@abovalve.com
www.abovalve.com

China:
ABO Flow Control
Beijing
Tel: +86 13601522831
Email: wen@abovalve.com
www.abovalve.com

Bahrain:
ABO Middle East
Kingdom of Bahrain
Tel.: +973 - 7700 2436
Email: jimmichen@abovalve.com
www.abovalve.com

Serie L9

LUG butterfly valve

Application fields

WATER | CONDITIONING | GAS | HEATING | DRINKING WATER | INDUSTRY | FIRE FIGHTING

The shut-off LUG butterfly valves in Series L9, with a centred Disc and LUG type body, are made of ductile iron, manufactured in accordance with severe product norms and in conformity to EN ISO 9001.
These valves are suitable for heating and conditioning (HVAC), water treatment and water distribution, industrial applications, agricultural purposes, for compressed air, gas, oils and hydrocarbon.
(Please ensure the choice of the corresponding item)

YES: for in line and end of line installation with frequent actuation; the integrated support, in accordance with ISO 5211, allows easy mounting of a wide range of actuators and drives.
They are suitable for choking and regulating the flow.

NO: for steam.

1. Epoxy coating.
2. Lever suitable for intermediate regulation.
3. Lockable operation lever.
4. A notch machined at the top of the stem indicates the position of the disc and allows adjusting the command to the correct position, when the command/lever is removed.
5. Compact design.
6. Integrated ISO 5211 flange.
7. Threaded holes suitable for mounting between PN16 for DN25-300 flanges (on request PN 10) and for mounting between PN 10 for DN 350-600 flanges.

Accessories

- Extension for water main system connection
- Position indicator and padlocking for gear box
- Micro-switch for gear box
- Kit: micro-switches for ON/OFF position indicator

Actuators

- Double acting and single acting pneumatic actuators
  On request: micro-switches, position indicators
- Electric actuators
- Gear box
- Chain driven control

Refer to specifications on page 75

CE In conformity with directive 97/23/CE PED
In conformity with D.M. 174 (directive 97/83/CE)

Construction and testing norms (correspondences):

Face-to-face: EN558/1-20 (ISO 5752-20, DIN 3202K1)
Flanges: EN1092, ANSI B16.5 #150
Design: EN593, EN13445, ISO 5211, EN12570
Marking: EN19
Testing: 100% testing in accordance with EN 12266 cat. A (ISO 5208 cat. A)

L9 DN25-250

L9 DN300-600

DN25-300

DN350-600

Materials

	Component	Material
1	Body	EN GJS 400 - 15
2	Disc	EN GJS 400 - 15 nickel plated / ASTM A351 gr. CF8-M / CuAl11Fe4 ASTM B148 C94500
3	Stem	AISI 420
4	Liner	EPDM / NBR / FKM (Viton®) / PTFE
5	Bushing	PTFE
6	Washer	Galvanized carbon steel
7	Cirlclip ISO3075	Spring steel
8	O-ring	FKM (Viton®)
9	Lever	DN25-150 aluminium / DN 200-250 EN GJS 400-15
10	Bolts	Galvanized carbon steel

Dimensions (mm)

DN	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
A	33	33	33	43	46	46	52	56	56	60	68	78	78	102	114	127	154
ØC	65	73	82	89	102	118	150	174	205	260	318	376	438	489	539	594	695
D	104	110	116	126	136	150	170	180	200	230	266	292	368	400	422	480	562
B	51	56	63	62	69	90	106	119	131	166	202	235	267	297	318	355	444
F1	192	192	170	170	170	206	206	285	285	400	530	-	-	-	-	-	-
Z	68	68	50	50	50	69	69	90	90	72	72	-	-	-	-	-	-
F2	130	130	130	130	130	130	130	130	130	235	226	226	216	216	216	256	285
L	102,5	102,5	102,5	102,5	102,5	102,5	102,5	102,5	102,5	190	190	190	183	183	183	311	386
T	65	65	65	65	65	65	65	65	65	78	80	80	80	80	80	125	136
L1	110	110	110	110	110	110	110	110	110	155	170	170	151	151	151	214	262
L2	130	130	130	130	130	130	130	130	130	176	200	195	188	188	188	275	324
W	45	45	45	45	45	45	45	45	45	63	81	81	80	80	80	168	293
O	150	150	150	150	150	150	150	150	150	300	300	300	285	285	285	285	385
R	-	1	5	5	9	17	26	34	50	71	91	112	128	144	163	182	219
D min pipe	-	12	27	31	45	65	90	110	146	194	241	291	324	379	428	475	573

Mounting between flanges [1] — **EN 1092 PN16** — **EN 1092 PN10**

n x M	4 x M12	4 x M16	4 x M16	4 x M16	4 x M16	8 x M16	8 x M16	8 x M16	8 x M20	12 x M20	12 x M24	12 x M24	16 x M20	16 x M24	20 x M24	20 x M24	20 x M27
ISO 5211	F05	F05	F05	F05	F05	F05	F05	F07	F07	F10	F12	F12	F12	F14	F14	F14	F16
G	65	65	65	65	65	65	65	90	90	1 25	1 50	1 50	1 50	175	175	175	210
J	50	50	50	50	50	50	50	70	70	1 02	1 25	1 25	1 25	140	140	140	165
n x q	4 x 7	4 x 7	4 x 7	4 x 7	4 x 7	4 x 7	4 x 7	4 x 9	4 x 9	4 x 11	4 x 13	4 x 13	4 x 13	4 x 18	4 x 18	4 x 18	4 x 22
S	7	7	9	9	9	11	1 1	1 4	1 4	1 7	27	27	31,6	33,15	38	41,15	50,65
E	32	32	21	21	21	21	21	27	27	27	27	27	45	51,2	51,2	64,2	70,2

Weight (kg)

L9 with lever	2,6	2,6	2,3	3,2	4,1	5,4	6,7	9,6	10,8	21,1	32,7	41,2	-	-	-	-	-
L9 with gear box	6,2	6,2	6,1	7,0	7,9	9,2	10,5	12,9	14,1	28,4	42,0	50,5	79,3	122,6	254,8	228,3	308,6

1: *please refer to Instruction and Recommendations*

Operating torque (Nm)

DP bar																	
3	2,9	4,7	7,8	11,3	17	23	33	48	68	120	189	290	298	481	930	1250	2270
6	3,1	5,1	8,4	1 2	1 8	25	36	54	78	134	212	316	347	551	980	1350	2500
10	3,3	5,4	8,8	13	20	26	40	61	88	148	234	342	396	622	1200	1500	2700
16	3,4	5,7	9,2	13	21	28	44	68	99	162	257	367	-	-	-	-	-

N.B.: *In order to choose the right actuator, we recommend multiplying the operating torque figure by a safety coefficient, K=1.5*

Maximum pressure

Fluids *	Mounting	
	BETWEEN FLANGES	END OF LINE
Hazardous gases	16 bar DN25-200 10 bar DN250-350 NO DN400-600	10 bar DN25-100 NO DN125-600
Non-hazardous gases	16 bar DN25-300 10 bar DN350-500 6 bar DN600	10 bar DN25-300 6 bar DN350-500 4 bar DN600
Hazardous fluids	16 bar DN25-400 10 bar DN450-600	10 bar DN25-400 6 bar DN450-600
Non-hazardous fluids	16 bar DN25-400 10 bar DN450-600	10 bar DN25-400 6 bar DN450-600

*: Hazardous gas, liquids (explosive, inflammable, toxic) in accordance with 97/23/CE PED and 67/548/EEC

Temperature

Temperature	min °C	Max°C	
		continuous	peak
EPDM	-10	120	130
NBR	-10	80	90
FKM (Viton®)	-10	150	170
PTFE	-10	120	120

NB: *the maximum working pressure decreases while the temperature increases; please refer to "pressure/temperature" chart*

Pressure/temperature chart

RANGE NOT SUITABLE FOR STEAM. DO NOT use when temperature and pressure are below the liquid-steam saturation line (hatched area)

Head loss **Fluid: water** (1m H2O = 0,098bar) - **Head loss with shutter completely open**

Flow rate / opening position chart **Flow percentage on the flow at full opening under the same loss of head.**

Kv - DN chart (mc/h per bar)

DN	mm	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
	ins	1" 1/2	2"	2" 1/2	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"
OPENING ANGLE	10°	0,04	0,05	0,09	0,17	0,26	0,43	0,69	1,73	2,6	3,5	5,2	6,9	9,5	12	19
	20°	2,1	2,6	5,2	7,8	15	25	39	77	130	202	292	401	531	683	1055
	30°	4,8	6	10	16	31	53	82	162	276	427	617	849	1124	1445	2234
	40°	10	13	22	34	67	115	177	352	599	926	1376	1839	2437	3133	4840
	50°	19	23	39	60	120	205	316	628	1068	1650	2384	3279	4342	5609	8626
	60°	30	38	65	100	199	339	522	1038	1768	2730	3945	5425	7185	9238	14272
	70°	48	60	103	158	314	535	827	1643	2798	4322	6243	8585	11371	14620	22587
	80°	73	91	161	237	471	803	1241	2465	4196	6483	9364	12878	17057	21930	33882
	90°	79	99	169	261	518	883	1364	2708	4611	7124	10291	14152	18743	24099	37232

Versions

EPDM liner

0

EN GJL 250
N GJS400 nickel plated
PDM
-10 +120°C

L9.100

Body: EN GJS 400 -15
Disc: EN GJS400 nickel plated
Liner: EPDM
Temp: -10 +120°C

L9.120

Body: EN GJS 400 -15
Disc: AISI 316
Liner: EPDM
Temp: -10 +120°C

L9.170

Body: EN GJS 400 -15
Disc: Aluminium-bronze
Liner: EPDM
Temp: -10 +120°C

Coating: **RAL 5002** colour

NBR liner

01

EN GJS 400 -15
EN GJS400 nickel plated
NBR
: -10 +80°C

L9.121

Body: EN GJS 400 -15
Disc: AISI 316
Liner: NBR
Temp: -10 +80°C

L9.171

Body: EN GJS 400 -15
Disc: Aluminium-bronze
Liner: NBR
Temp: -10 +80°C

Coating: **RAL 5002** colour - GAS version (DN 25-350) with yellow lever

FKM or PTFE liner

2

EN GJS 400 -15
N GJS400 nickel plated
KM
-10 +150°C

L9.122

Body: EN GJS 400 -15
Disc: AISI 316
Liner: FKM
Temp: -10 +150°C

L9.172

Body: EN GJS 400 -15
Disc: Aluminium-bronze
Liner: FKM
Temp: -10 +150°C

L9.123

Body: EN GJS 400 -15
Disc: AISI 316
Liner: PTFE
Temp: -10 +120°C

L9.173

Body: EN GJS 400 -15
Disc: Aluminium-bronze
Liner: PTFE
Temp: -10 +120°C

Coating: **RAL 5002** colour

Special versions on request

Accessories for series J9 - L9

Stem extension for water main system connection

DN	40-100	125-150	200	250-300
H	250-500-800-1000			
ISO5211	F05	F07	F10	F12
G	65	90	125	150
J	50	70	102	125
n° x Ø q	4 x 7	4 x 9	4 x 11	4 x 13
E	20	26	26	26
S	11	14	17	27

Position indicator and padlocking for gear box

DN	25-150	200-400
A	100	120
B	60	80

1) Position indicator
2) Chain for padlocking

Limit switches box for gear box

Mechanical switches per standard.
Available on request: proximity switches,
ATEX explosion proof proximity switches.

Limit switches kit for ON-OFF indication

Chain driver kit

Instruction and Recommendations for series J9 - L9

The information provided here is delivered with each product, and contains "Instructions for use and maintenance"; it is also available on our website: www.brandoni.it (download section)

INSTALLATION AND TRANSPORT

- Keep in dry and closed place.
- While stored, the disc must be partially open (Fig. 1).
- Avoid knocks, take special care to protect lever, hand wheel, gear boxes/actuators.
- Do not use lever or hand wheel to lift the valve.

MAINTENANCE

The valve does not require maintenance.

RECOMMENDATIONS

Before carrying out maintenance or dismantling the valve, be sure that the pipes, valves and liquids have cooled down, that the pressure has decreased and that the lines and pipes have been drained in case of toxic, corrosive, inflammable or caustic liquids.
Temperatures above 50°C and below 0°C might cause damage to people.

INSTALLATION

- Handle with care.
- Do not weld the flanges to the piping after installing the valve.
- Water hammers might cause damage and ruptures. Inclination, twisting and misalignments of the piping may subject the valve to stress, once installed. It is recommended that elastic joints be used in order to reduce these effects as much as possible. The disc must be partially open (Fig. 1).

FIG. 1

FIG. 2

FIG. 3

The stem has a machined notch N (Fig. 2), which indicates the position of the disc; consider this indication, in order to mount the levers and actuators correctly.
The mounting can be made with the stem axis in a horizontal or vertical position. In case the fluid contains suspended solid particles (for example, sand, impurities, etc.) o solid particles that may leave deposits, it is recommend that the valve be installed with its axis horizontal, and in such a way that the bottom end of the disc opens in the direction of flow, F. (Fig. 3)
The item L9 allows the dismantling of the pipes downstream, for pressures below 6 bar. For end of line installation:
- SERIES J9 (all pressures), series L9 (pressure > 6 bar): counter flange MUST be installed
- SERIES L9 (pressure< 6 bar): it is recommended that a counter flange be installed.

Verify maximum working pressure and limits of use under section "maximum pressure".
Place the valve between two flanges. While placing the valve, ensure there is sufficient space in order in order not to damage the rubber. Do not mount seals between valve and flanges (Fig. 1). Carefully clean the contact surface. Do not install the butterfly valve in direct contact with a rubber surface (for example, expansion joints); the best installation is when the rubber is in contact with metal (Fig. 4).
In order to achieve correct working, the internal diameter of the pipe must be greater than the value indicated in the chart. Do not weld the flanges to the tube if the valve has already been installed. It is recommended that the flanges listed in the chart be used. As far as possible, avoid flat flanges for welding (EN 1092 01 type); if these flanges are used, ensure perfect centring between the flange and valve, and be sure to weld exactly edgewise to the flange. Do not let protrusions or sharp edges on the piping cause damage to the rubber surface of the valve (Fig. 5).

FIG. 4

FIG. 5

Centre the valve on holes while using wafer type valves.
Tighten the bolts crosswise and progressively, in order to distribute the pressure equally before the body and flanges come into contact with each other. (Fig. 6)
With regard to the Lug version, check that the screws are the correct length, in order to allow complete compression of the lining rubber.
Turbulences of the fluid might increase erosion and reduce the life-cycle of the valve. Install the valve at a distance of at least 1 x DN upstream, and at a distance of 2-3 x DN downstream, away from fittings or bends.
In the open position, the valve is larger than the nominal Face to Face value.

FIG. 6

Check that no other components of the piping interfere or create damage or malfunction (Fig. 7A).
If they do, a spacer should be inserted for the valve to operate correctly (Fig. 7B).

FIG. 7A

FIG. 7B

FLANGES CHART

Norms	Type	
EN 1092-1 PN6/10/16	Type 11	weld neck
	Type 21	integral
	Type 02 + 35	loose plate with weld ring neck
	Type 02 + 36	loose plate with pressed collar
	Type 04 + 34	loose plate with weld neck collar
ANSI B16.1 #150* ANSI B16.5 #150*		flat face
		raised face
		lap joint

CHART MINIMUM DIAMETER OF PIPES

DN	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
Ø min. pipe	-	12	27	31	45	65	90	110	146	194	241	291	324	379	428	475	573

Customer	Date 2015-03-11
Contact	Project
Phone number	Project no.
Email	

NSCS 100-250/150/W46VCC4

Technical Data

Operating data

Pumpe type	Single head pump			Fluid		Water
No. of pumps / Reserve			1 / 0	Operating temperature t A	°C	4
Nominal flow		m³/h	189.2	pH-value at t A		7
Nominal head		m	20.4	Density at t A	kg/dm³	1
Static head		m	0	Kin. viscosity at t A	mm²/s	1.569
Inlet pressure		bar	0.098	Vapor pressure at t A	bar	0.0234
Environmental temperature		°C	20	Solids		0
Available system NPSH		m	0	Altitude	m	1000

Pump data

Make	Lowara				Nominal	m³/h	196	(196)
Speed		1/min	1765	Flow	Max-	m³/h	249	
Number of stages			1		Min-	m³/h	29.6	
Max. casing pressure		bar	16		Nominal	m	21.9	
Max. working pressure		bar	2.9	Head	at Qmax	m	15.9	
Head H(Q=0)		m	28		at Qmin	m	28.2	
Weight		kg		Shaft power		kW	14.2	(14.2)
	Max.	mm	259	Max. shaft power		kW	14.8	
Impeller R	designed	mm	245	Efficiency		%	82.14	
	Min.	mm	222	NPSH 3%		m	2.6	
Suction nozzle			DN125 PN10/16 EN1092-2 (NSC)	Discharge nozzle			DN100 PN10/16 EN1092-2 (NSC)	

Pump Materials

Impeller	Cast iron, 0.6020
Casing	Cast iron, 0.6025
casing cover	Cast iron, 0.6025
Wear ring	stainless steel, 1.4301
Shaft	Stainless steel, 1.4057
Bearing frame	Cast iron, 0.6025

Shaft Seal

Mechanical Seal	
e-NSC, e-LNE - MG1S2	Burgmann
Rotating Assembly	B-Resin impregnated carbon
Fixed Assembly	Q1-Silicon carbide
Elastomers	E - EPDM
Springs	G-AISI 316
Other Components	G-AISI 316

Motor data

Manufacturer	WEG	Electric voltage	460 V
Specific design	IE3 motors - Cast Iron Frame - Premium Efficiency		
Type	W22 - 160 L - 15kW	Electric current	25 A
Rated power	15 kW	Degree of protection	IP55
Speed	1775 1/min	Insulation class	F
Frame size	160 L	Weight	145 kg
Shaft diameter	42 mm	Colour	RAL 5010

Coupling

Manufacturer	
Series	
Type	
Frame size	
Spacer length	
Weight	
Coupling protection	

Base plate

Description	
Weight	

Remarks:

Customer Contact Phone number Email	Date 2015-03-11 Project Project no.

NSCS 100-250/150/W46VCC4

Hydraulic data

Operating Data Specification		Hydraulic data (duty point)		Impeller design	
Flow	189.2 m³/h	Flow	196 m³/h	Impeller R	245 mm
Head	20.4 m	Head	21.9 m	Frequency	60 Hz
Static head	0 m			Speed	1765 1/min

Power datas referced to:
Water [100%] ; 4°C; 1kg/dm³; 1.57mm²/s
Performance according to ISO 9906 - Annex A

Customer		Date	2015-03-11
Contact		Project	
Phone number		Project no.	
Email			

NSCS 100-250/150/W46VCC4

Dimensions mm/m³

a	140	m2	120
A	254	n1	400
AA	64	n2	315
AB	308	PM1	1/4"
AD	264	s1	19
B	254	s2	14.5
b	80	Trim	0
BB	298	Type	B
Bmax	431	Volumen	0.1985
DNd	100	w	348
DNs	125	x	140
E	3/8"		
f	240		
F	3/8"		
g1	26		
H	160		
h1	225		
h2	280		
h3	65		
HA	22		
Hmax	505		
L	912		
m1	160	Total weight	235 kg

Connections mm

Suction nozzle	Discharge nozzle
DN125	DN100
PN10/16	PN10/16
EN1092-2 (NSC)	EN1092-2 (NSC)

C	26	C	24
D	255	D	230
d1	184	d1	157
K	210	K	180
L	19	L	19
z	8	z	8

Value C, D may vary from Standard

Drawing

PM1..Pressure gauge connector
E....Drain
F....Filling

Customer	Date 2015-03-11
Contact	Project
Phone number	Project no.
Email	

NSCS 100-160/40/W46VCC4

Technical Data

Operating data

Pumpe type		Single head pump		Fluid		Water
No. of pumps	/ Reserve	1 / 0		Operating temperature t A	°C	4
Nominal flow	m³/h	86		pH-value at t A		7
Nominal head	m	10.2		Density at t A	kg/dm³	1
Static head	m	0		Kin. viscosity at t A	mm²/s	1.569
Inlet pressure	bar	0.098		Vapor pressure at t A	bar	0.0234
Environmental temperature	°C	20		Solids		0
Available system NPSH	m	0		Altitude	m	1000

Pump data

Make	Lowara				Nominal	m³/h	84.6	(84.6)
Speed		1/min	1760	Flow	Max-	m³/h	187	
Number of stages			1		Min-	m³/h	28.5	
Max. casing pressure		bar	16		Nominal	m	9.9	
Max. working pressure		bar	1.1	Head	at Qmax	m	4.7	
Head H(Q=0)		m	10		at Qmin	m	10.2	
Weight		kg		Shaft power		kW	3.5	(3.5)
	Max.	mm	190	Max. shaft power		kW	3.9	
Impeller R	designed	mm	156	Efficiency		%	65.45	
	Min.	mm	156	NPSH 3%		m	2	
Suction nozzle			DN125 PN10/16 EN1092-2 (NSC)	Discharge nozzle			DN100 PN10/16 EN1092-2 (NSC)	

Pump Materials

Impeller	Cast iron, 0.6020
Casing	Cast iron, 0.6025
casing cover	Cast iron, 0.6025
Wear ring	stainless steel, 1.4301
Shaft	Stainless steel, 1.4057
Bearing frame	Cast iron, 0.6025

Shaft Seal

Mechanical Seal	
e-NSC, e-LNE - MG1S2	Burgmann
Rotating Assembly	B-Resin impregnated carbon
Fixed Assembly	Q1-Silicon carbide
Elastomers	E - EPDM
Springs	G-AISI 316
Other Components	G-AISI 316

Motor data

Manufacturer	WEG	Electric voltage	460 V
Specific design	IE3 motors - Cast Iron Frame - Premium Efficiency		
Type	W22 - 112 M - 4kW	Electric current	7.1 A
Rated power	4 kW	Degree of protection	IP55
Speed	1755 1/min	Insulation class	F
Frame size	112 M	Weight	44 kg
Shaft diameter	28 mm	Colour	RAL 5010

Coupling

Manufacturer	
Series	
Type	
Frame size	
Spacer length	
Weight	
Coupling protection	

Base plate

Description	
Weight	

Remarks:

Customer Contact Phone number Email	Date 2015-03-11 Project Project no.

NSCS 100-160/40/W46VCC4

Hydraulic data

Operating Data Specification		Hydraulic data (duty point)		Impeller design	
Flow	86 m³/h	Flow	84.6 m³/h	Impeller R	156 mm
Head	10.2 m	Head	9.87 m	Frequency	60 Hz
Static head	0 m			Speed	1760 1/min

Power datas referced to:
Water [100%] ; 4°C; 1kg/dm³; 1.57mm²/s
Performance according to ISO 9906 - Annex A

Customer		Date	2015-03-11
Contact		Project	
Phone number		Project no.	
Email			

NSCS 100-160/40/W46VCC4

Dimensions mm/m³

a	125	Volumen	0.11938
AD	192	x	140
b	80		
Bmax	388		
DNd	100		
DNs	125		
E	3/8"		
f	183		
F	3/8"		
g1	26		
h1	200		
h2	280		
h3	88		
Hmax	480		
L	641		
m1	160		
m2	120		
n1	360		
n2	280		
PM1	1/4"		
s1	19		
Trim	0		
Type	A	Total weight	119 kg

Connections mm

Suction nozzle	Discharge nozzle
DN125	DN100
PN10/16	PN10/16
EN1092-2 (NSC)	EN1092-2 (NSC)

C	26	C	24
D	255	D	230
d1	184	d1	157
K	210	K	180
L	19	L	19
z	8	z	8

Value C, D may vary from Standard

Drawing

PM1..Pressure gauge connector
E...Drain
F....Filling

Customer Contact Phone number Email	Date 2015-08-27 Project Project no.

Technical Data

NSCS 100-160/40/W45VCC4

703740820

Operating data

Pumpe type		Single head pump		Fluid		Water, pure
No. of pumps	/ Reserve	1 / 0		Operating temperature t A	K	277
Nominal flow	m³/h	0		pH-value at t A		7
Nominal head	m	0		Density at t A	kg/m³	1000
Static head	m	0		Kin. viscosity at t A	mm²/s	1.569
Inlet pressure	kPa	9.8		Vapor pressure at t A	kPa	2.34
Environmental temperature	K	293		Solids		0
Available system NPSH	m	0		Altitude	m	1000

Pump data

Make	Lowara					Nominal	m³/h	(	)
Speed		1/min	1450		Flow	Max-	m³/h	193	
Number of stages			1			Min-	m³/h	25	
Max. casing pressure		kPa	1600			Nominal	m		
Max. working pressure		kPa	105.9		Head	at Qmax	m	4.6	
Head H(Q=0)		m	11			at Qmin	m	10.7	
Weight		kg			Shaft power		kW	(	)
	Max.	mm	190		Max. shaft power		kW	3.7	
Impeller R	designed	mm	190		Efficiency		%		
	Min.	mm	144		NPSH 3%		m		
Suction nozzle			DN125 PN10/16 EN1092-2 (NSC)		Discharge nozzle			DN100 PN10/16 EN1092-2 (NSC)	

Pump Materials

Impeller	Cast iron, 0.6020
Casing	Cast iron, 0.6025
casing cover	Cast iron, 0.6025
Wear ring	stainless steel, 1.4301
Shaft	Stainless steel, 1.4057
Bearing frame	Cast iron, 0.6025

Shaft Seal

Mechanical Seal	
e-NSC, e-LNE - MG1S2	Burgmann
Rotating Assembly	B-Resin impregnated carbon
Fixed Assembly	Q1-Silicon carbide
Elastomers	E - EPDM
Springs	G-AISI 316
Other Components	G-AISI 316

Motor data

Manufacturer	WEG	Electric voltage	400 V
Specific design	IE3 motors - Cast Iron Frame - Premium Efficiency		
Type	W22 - 112 M - 4kW	Electric current	8 A
Rated power	4 kW	Degree of protection	IP55
Speed	1450 1/min	Insulation class	F
Frame size	112 M	Weight	44 kg
Shaft diameter	28 mm	Colour	RAL 5010

Coupling

Manufacturer	
Series	
Type	
Frame size	
Spacer length	
Weight	
Coupling protection	

Base plate

Description	
Weight	

Remarks:

Customer Contact Phone number Email	Date 2015-08-27 Project Project no.

NSCS 100-160/40/W45VCC4

703740820

Hydraulic data

Operating Data Specification		Hydraulic data (duty point)	Impeller design	
Flow	0 m³/h	Flow	Impeller R	190 mm
Head	0 m	Head	Frequency	50 Hz
Static head	0 m		Speed	1450 1/min

Power datas referced to:
Water, pure [100%] ; 277K; 1000kg/m³; 1.57mm²/s
Performance according to ISO 9906 - Annex A

Tender Hydraulic

Customer	Date 2015-08-27
Contact	Project
Phone number	Project no.
Email	

NSCS 100-160/40/W45VCC4

703740820

Dimensions mm/l

a	125	Volumen	0.11938
AD	192	x	140
b	80		
Bmax	388		
DNd	100		
DNs	125		
E	3/8"		
f	183		
F	3/8"		
g1	26		
h1	200		
h2	280		
h3	88		
Hmax	480		
L	641		
m1	160		
m2	120		
n1	360		
n2	280		
PM1	1/4"		
s1	19		
Trim	0		
Type	A	Total weight	119 kg

Connections mm

Suction nozzle	Discharge nozzle
DN125	DN100
PN10/16	PN10/16
EN1092-2 (NSC)	EN1092-2 (NSC)

C	26	C	24
D	255	D	230
d1	184	d1	157
K	210	K	180
L	19	L	19
z	8	z	8

Value C, D may vary from Standard

Drawing

PM1..Pressure gauge connector
E...Drain
F....Filling

SONDEX

S21/S22 + S36+S47 + S64
Plate Heat Exchanger

Recommended Applications:
The **S21/S22, S36+S47 and S64** range of **Sondex** plate heat exchangers is specially designed for the HVAC area, the geothermal-, marine- and heat recovery area as well as for the industrial- and chemical market.

Design Principle:
The **Sondex** plate range with lengths up to 1.9 m and up to extra "long" thermal pattern, will cover many duties up to 150 m^3/h in a single pass solution, which means that all connections are on the head side. This will ensure easy pipe- and service work, and by dismantling the exchanger for service, no pipes need to be removed.

The heat transfer is obtained, when the warm medium transfers energy through the thin, strong flow plates between the channels and delivers it to the cold opposing medium without mixing the two media. Countercurrent flow creates the optimum efficiency.

The plate- and inlet design allows an effective and easy CIP (Cleaning In Place) of all "flow" surfaces.

Flow Plates:
The corrugated "herringbone" pattern ensures turbulent flow in the whole effective area. Furthermore, this pattern brings "metallic" contact between the plates, and together with lock devices on the gaskets, the plate pack is easily assembled.

The plate pack is held firm and safely between the fixed head and movable follower of the frames.

Data Required for Correct Quotation:
Duty, flow rate, type of media, temperatures, working pressure, pressure losses and thermodynamic properties determine the choice of exchanger type, size of heat surface and plate pattern.

Technical Information

Frame:
Painted frame with the clamping bolts placed around the frame edge.
Standard colour by painted frame: Blue RAL 5010.
Available in other colours.

Working pressure:
The painted frames are designed for working pressure: 0.6/1.0/1.6/2.5 MPa

Intermediate Frames:
Intermediate frames and corner blocks for IS and FS frames in stainless steel.

Construction Standard:
According to PED 97/23/EC:
A-D "Merkblätter"
According to ASME CODE:
ASME VIII, DIV. 1

Connections:
DN100 flange Carbon steel, rubberlined or cladded, with AISI316 or titanium.

According to all known standards.
3" & 4"/DN80/100 dairy unions.
According to all known standards.

Plates:
Standard material
AISI 304, AISI 316 and titanium, 254 SMO.
Also 2 x 0.4 mm "Sonder Safe" plates.
Not standard: Hastelloy C 276 and other pressable materials.

Gaskets:
The gaskets are the unique "Sonder Lock" or "hang-on", non-glued type.
Standard material: Nitrile, EPDM and Viton.

Extra Equipment:
Safety covers in stainless steel.
Insulating jacket.
Assembling spanner.
Foundation feet for frame.

F1-F4 AND B1-B4
DN100 DIN2632/2633
CLADDED OR RUBBERLINED

F1-F4
DN100 DIN2632/2633
UNCLADDED

F1-F4 AND B1-B4
4 INCH ANSI CL150
DCD 2,5 MM
CLADDED OR RUBBERLINED

F1-F4
4 INCH ANSI CL150
DCD 2,5 MM
UNCLADDED

Dimensions without tolerance: ISO 2768-m	Designed by JKO 08-11-2010	Approved by JRD 16-07-2012	Rev. no. 03	Revision Text: CHANGED HEAD-FOLL-COLUMN-CARR BAR
ISO projektion	SONDEX Jernet 9 DK-6000 Kolding		Description: S47 IG PN10 DN100 DIM DRAWING LENGTH 400-1000 MM	
			Rev. date 13-07-2012	Rev. by LGK
			Drawing no. S47IGPN10DN100L400-1000	Sheet 1 /1

Media: air – water – light oil - vacuum
Pressure range: 0 to 10 bar max
Media temperature: 90° C max
Ambient temperature: -20° to +60° C max
Media viscosity: 50 centistokes max
Mounting: coil upright
Opening / Closing Time: 50 mSec Max

NC

2/2 Brass

N/CLOSED
2 WAY ASSISTED LIFT

TYPE PU220 & AD

PRESSURE

Ø Port	Ø Orifice (mm)	Flow Rate Cv Ltr/ min	Coil Size	Pressure Rating (bar) Min	Max ΔP DC	Max ΔP AC	Max Working	Seals	Max Media Temp. °C	Part Number
3/8 BSP	13	35	22003	0	5	8.5	10	NBR FKM EPDM	90 120 120	PU22003 + voltage PU22003V + voltage PU22003E + voltage
1/2 BSP	13	35	22003	0	5	8.5	10	NBR FKM EPDM	90 120 120	PU22004A + voltage PU22004AV + voltage PU22004AE + voltage
3/4 BSP	20	72	22003	0	5	8.5	10	NBR FKM EPDM	90 120 120	PU22006A + voltage PU22006AV + voltage PU22006AE + voltage
1 BSP	25	183	22003	0	5	7	10	NBR FKM EPDM	90 120 120	PU22008A + voltage PU22008AV + voltage PU22008AE + voltage
11/4 BSP	35	400	WPA2	0	7	10	10	NBR FKM EPDM Silicone	90 120 120 120	AD35N + voltage AD35V + voltage AD35E + voltage AD35S + voltage
11/2 BSP	35	400	WPA2	0	7	10	10	NBR FKM EPDM Silicone	90 120 120 120	AD40N + voltage AD40V + voltage AD40E + voltage AD40S + voltage
2 BSP	51	580	WPA2	0	5	7	10	NBR FKM EPDM Silicone	90 120 120 120	AD50N + voltage AD50V + voltage AD50E + voltage AD50S + voltage

OPTIONS

Connector PG9 – DIN 43650 A
IP65 Coil
Explosion Proof Coil: EExmIIT4 ATEX IIG IP65 T 130°C (Optional T6 T 85°C)
NPT
HTA2 Coil 200°C N Rated (WPA2 size only)

ELECTRICAL DATA

Voltage (-10% + 10%) Continuous duty 100%		Coil Size	Power Inrush	Power Holding	Insulation class	Enclosure	Electrical connections
~	24 - 48 - 110 - 240 - 380 (50 or 60 Hz)	22003	23VA	17VA	H 180°C	*IP 65 with connector*	3 spades DIN 43650A DIN 40050 VDE 0110
=	12 - 24 - 48 - 110 (DC)		15 Watts				
~	24 - 110 - 230 (50 or 60 Hz)	WPA2	40VA	24.2VA	F 155°C		
=	12 - 24 (DC)		18 Watts				

CONSTRUCTION

Body: Brass
Tube and internal parts: Stainless steel
Seals and gaskets: NBR (Optional EPDM or FKM)
Moulded coil: Resin

REPAIR KIT

Diaphragm seal	Valve part number + material
Coil	Coil size (22003 or WPA2) + voltage
Complete plunger + O' rings	KIT+ valve part number

OVERALL DIMENSIONS

Model	PU220 03	PU220 04A	PU220 06A	PU220 08A	AD35	AD40	AD50
Port R	3/8	½	¾	1	11/4	11/2	2
A	66.5	66.5	71.0	96.0	120	120	150
B	101.0	101.0	107.0	120.5	140	140	160
C	48.0	48.0	58.0	70.0	90	90	120
Kg	0.74	0.715	0.92	1.4	2.87	2.77	4.81

N/Open
Page 22

Dial Thermometer – Rigid Stem

Nominal Size
63mm • 100mm • 160mm • 250mm

Accuracy
± 1% FSD

Case Material
304 stainless steel.

Stem Material
316 stainless steel.

Stem Length
From 100mm - 2 metres (depending on range)

Other Options
Dual Scale
Electrical Contacts, single or double
Max. indicating pointers
Glycerine Filled Heads
Anti-vibration Springs (Pyrometers)
Plastic Window
Various ranges available.
Various fittings available.
Non-toxic system available.
Bimetallic also available

TEMPERATURE PROBES & ACCESSORIES

- STANDARD OR CUSTOM PROBES
- RTD, TC OR THERMISTOR
- CHOICE OF TERMINATION STYLES
- TRANSMITTER OPTIONS
- FULL RANGE OF THERMOWELLS

INTRODUCTION

Status Instruments Ltd provide a complete range of sensors for temperature measurement. Our sensors include:

- PLATINIMUM RESISTANCE TEMPERATURE DETECTORS
- THERMOCOUPLES
- THERMISTORS

Our experience has enabled us to offer a comprehensive range of styles to provide the ideal sensor for every application and all manufactured under our ISO 9001 quality procedures. Complete sensor assemblies may be ordered by simply specifying the respective order code for each component required. Unless you specifically request that the components are to be supplied separately, we will assemble the components into a complete unit.

SENSOR SENSITIVITY

This may be defined as the change in sensor output relative to the temperature change it is detecting. Thermocouples produce a non-linear voltage output proportional to the temperature difference between the Hot or measuring junction and the Cold or reference junction, sensitivities vary typically from about (20 to 50) µV/°C. Pt100 Platinum resistance sensors change their resistance as a function of temperature. The most commonly used exhibit a 0.385 Ω/°C change. Thermistors provide a much higher change of resistance with temperature, but have restricted ranges and are very non-linear unless used over narrow temperature spans.

STANDARD TEMP. SENSORS (STS) SERIES

Temperature sensors can be supplied in a variety of styles and configurations, utilising thermocouple or thermistor elements as an alternative to Pt100 elements. If your exact requirements are not readily identified please contact our sales staff who will be pleased to discuss your application and provide a quotation.

(All dimensions in mm unless otherwise stated)

STS STYLE 1

Welded 316 ST/STEEL construction for screw fitting into process connections or STW series pockets (except style 2).

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	6.0 dia x 75, 100, 150, 200, 250 immersion
Process Thread	½" BSP parallel
Extension	12.7 dia x 75 long
Head Thread	M24 x 1.5
Tails	3 wire 7/0.2Cu PTFE insulated, 150 long
Temp. Range	(-50 to 200) °C (at tip)

STS STYLE 2

All welded 316 ST/STEEL construction sensor for fitting into a compression gland.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	6.0 dia x 75, 100, 150, 200, 250 immersion
Head Thread	M24 x 1.5
Tails	3 wire 7/0.2 Cu PTFE insulated, 150 long
Temp. Range	(-50 to 200) °C (at tip).

STATUS INSTRUMENTS

TEMPERATURE PROBES & ACCESSORIES

STS STYLE 3
All welded 316 ST/STEEL construction combined inset sensor and pocket. This sensor is designed to be used with a spring mounting kit fitted to the transmitter or terminal block to provide faster response times. The type of transmitter/terminal block and connecting head required must be specified when ordering.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	7.9 dia x 75, 100, 150, 200, 250 immersion
Process Thread	½" BSP parallel
Extension	12.7 dia x 75 long
Head Thread	M24 x 1.5
Tails	3 wire 7/0.2 Cu PTFE insulated, 150 long
Temp. Range	(-50 to 200) °C (at tip)

STS STYLE 4
Flying lead sensor with 316 ST/STEEL sheath for fitting into a compression gland.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	6.0 dia x 75, 100, 150, 200, 250 immersion
Cable	3 wire 7/0.2 Cu PTFE insulated, 1 m long
Temp. Range	(-50 to 200) °C (at tip)

STS STYLE 5
Square aluminium block, strap-on-sensor with flying lead for clamping directly to pipes.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	¼ " square x 50 long
Extension	4.0 dia x 19 long
Cable	3 wire 7/0.2 Cu PTFE insulated, 1 m long
Temp Range	(-50 to 200) °C (at tip)

STS STYLE 6
316 ST/STEEL sensor suitable for energy management applications such as duct air and outside air temperature. This sensor can ONLY be used in conjunction with the SCH4 series connecting head.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	6.0 dia x 50, 150, 305 immersion
Flange	20.0 A/F Hex x 1.6 thick
Tails	3 wire 7/0.2Cu PTFE insulated, 75 long
Temp. Range	(-50 to 150) °C (at tip)

STS STYLE 7
All welded 316 ST/STEEL sensor with protective sheath suitable for energy management applications such as outside air temperature. This sensor can ONLY be used in conjunction with the SCH4 or DM500 (M16 entry) series connecting heads.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	12.7 dia x 50 long
Head Thread	M16 x 1.5
Tails	3 wire 7/0.2 Cu PTFE insulated, 75 long
Temp. Range	(-50 to 50) °C (at tip)

STS STYLE 8
Flying lead sensor with a 316 ST/STEEL sheath designed to be used as a direct replacement for mechanical thermometers in conjunction with the DM400 and DM500 series local indicators, see Instrument section.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	12.7 dia x 200 immersion length
Head Thread	M16 x 1.5
Cable	Flexible PVC sheath over cable 3 wire 7/0.2 Cu PTFE insulation, 1 m long
Temp. Range	(-50 to 200) °C (at tip)

STS STYLE 9
All welded 316 ST/STEEL sensor for screw fitting into process connections or STW series pockets. Designed to be used with the Status SCH4 connecting head or the DM400/500 local indicators it features a "running nut" head which enables the indicator to be orientated to the optimum viewing position.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	6.0 dia x 75,100,150,200,250 immersion
Process Thread	½" BSP parallel
Extension	9.5 dia x 75 long
Head Thread	M16 x 1.5
Tails	3 wire 7.0.2 Cu PTFE insulated, 150 long
Temp. Range	(-50 to 200) °C (at tip)

STATUS INSTRUMENTS

STS STYLE 10
All welded 316 ST/STEEL sensor for screw fitting into an internal thread hygienic type process connection.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	6.0 dia x 75,100,150,200,250 immersion
Process Thread	¾" BSP parallel male running nut
Extension	12.7 dia x 75 long
Head Thread	M24 x 1.5
Tails	3 wire 7.0.2 Cu PTFE insulated, 150 long
Temp. Range	(-50 to 200) °C (at tip)

STS STYLE 11
All welded 316 ST/STEEL sensor for screw fitting into an external thread hygienic type process connection.

Element	Pt100 to BS.EN 60751 IEC751 Class B*
Sheath	6.0 dia x 75,100,150,200,250 immersion
Process Thread	¾" BSP parallel female running nut
Extension	12.7 dia x 75 long
Head Thread	M24 x 1.5
Tails	3 wire 7.0.2 Cu PTFE insulated, 150 long
Temp. Range	(-50 to 200) °C (at tip)

STS STYLE 12
All welded 316 ST/STEEL sensor for fitting to various hygienic process connections e.g. IDF, RJT, SMS patterns. Due to the wide variety of type and size of fittings, all sensors to this style are manufactured to customers specifications.

STW SERIES POCKETS/ THERMOWELLS

Some sensors can be fitted directly into the process by means of an integral process connection or by using an appropriate compression fitting. Other applications require a pocket or thermowell which is a permanent fitting into the process yet allows the sensor to be inserted or removed without interruption.

Pockets invariably increase the response time and obviously the thicker and heavier the pocket the more the response time will be increased. Some styles use spring loading which keeps the inset in permanent contact with the pocket. However, it is the radial clearance between the inset and pocket which has the greatest influence on response time.

For improved response the inset should be assembled into the pocket using thermally conductive grease. The following illustrations show the six most popular styles of pockets/thermowells.

NOTE: Pocket immersion lengths are relative to the probe lengths shown.

STW STYLE 1
All welded 316 ST/STEEL construction for screw fitting into process connection, suitable for STS sensors Style 1 and 9.

Sheath	7.9 dia x 71, 96, 146, 196, 246 immersion
Probe lengths	75, 100, 150, 200, 250
Process thread	3/4" BSP Parallel
Internal thread	1/2" BSP

STW STYLE 2
All welded 316 ST/STEEL construction with brass compression gland, suitable for style 2, 4 & 6 sensors.

Sheath	7.9 dia x 23, 48, 98,148, 198 immersion
Probe lengths	75, 100, 150, 200, 250
Process thread	1/2" BSPT
Compression fitting	1/4" BSPT x 6.0 dia.

STW STYLE 3
All welded 316 ST/STEEL construction 'weld-in' pocket, suitable for Style 1,9 and Style 2, 4 & 6 sensors when used in conjunction with a compression gland.

Sheath	7.9 dia x 55, 80, 130, 180, 230 immersion
Probe lengths	75, 100, 150, 200, 250
Head	25.4 dia x 26 long typical
Internal Thread	1/2" BSP Parallel

TEMPERATURE PROBES & ACCESSORIES

STW STYLE 4

Solid turned 316 ST/STEEL construction sensor for screw fitting into process connection, suitable for Style 1 sensors.

Parallel Sheath	13.4 dia x 57 & 82 immersion
Probe lengths	75 & 100
Tapered Sheath	13.4 to 19.0 dia x 132, 182, 232 immersion
Probe lengths	150, 200, 250
Process Thread	$^{3}/_{4}$" BSP Parallel
Internal Thread	$^{1}/_{2}$" BSP Parallel

STW STYLE 5

All welded 316 ST/STEEL construction for bolting to a flanged process connection. Due to the wide variety of, dimensional, material, pressure and pipe size requirements, all thermowells of this style are manufactured to customers specifications.

ORDER CODE

STS / STYLE / IMMERSION LENGTH

Styles	**1 - 12**

Length	Styles 5, 6 & 7 only	**- 050**
	Not styles 5, 6 & 7	**- 075**
	Not styles 5 & 7	**- 150**
	Not styles 5, 6 & 7	**- 200**
	Not styles 5, 6 & 7	**- 250**
	Styles 6 & 12 only	**- 305**

EXAMPLE: STS2 / 075 - Style 2, 75 mm Immersion

*NOTE: Pt100 sensors are supplied as standard to Class B. They can be supplied to Class A or $^{1}/_{10}$ Class B on request. Sensors are also available with THERMOCOUPLE or THERMISTOR elements.

For special requirements please specify (where applicable) all details shown in diagrams, i.e. immersion length & diameter, extension length, element type, process thread, head thread, material & temperature range and in the case of hygienic sensors, the type and size of the fitting.

ORDER CODE

STS / STYLE / LENGTH

Styles	**1 or 2**

Length	**- 075**
	- 100
	- 150

EXAMPLE: EXT1 /150 - Style 1, 150 mm long

For special requirements please specify, style, process thread, extension length, head thread and any other relevant details.

ORDER CODE

STW / STYLE / IMMERSION LENGTH

Styles	**1 -6**

Immersion to suit std. sensor lengths	**- 075**
	- 100
	- 150
	- 200
	- 250
	- 305

Example: STW2/075 - Style 2 pocket to suit 75 mm standard probe.

Note: For Styles 5 & 6 or special requirements on other styles, please specify (where applicable) all details shown in diagrams.

Status Instruments Ltd
Status Business Park
Gannaway Lane, Tewkesbury
Gloucestershire, UK
GL20 8FD

Tel: +44 (0)1684 296818
Fax: +44 (0)1684 293746 Email:
sales@status.co.uk Website:
www.status.co.uk

STATUS INSTRUMENTS

Via Novara, 199 - 28078 **Romagnano Sesia** (No) ITALY
Tel. +39.0163.828.111 - Fax. +39.0163.828.130

E-mail: info@brandoni.it
Internet: www.brandoni.it
P. IVA/VAT NUMBER 00113680037

REV. 11-05-2009

brandoni S.p.A.
VALVOLE INDUSTRIALI

SINCERT
CERMET
SISTEMA DI GESTIONE CERTIFICATO
REG. N. 007-A
UNI EN ISO 9001-2000

CE 1115

MANUALE D'USO E MANUTENZIONE
MAINTENANCE AND USE HANDBOOK

VALVOLE DI RITEGNO A CLAPET WAFER
WAFER CHECK VALVES

SERIE 06-M6 - *SERIES 06-M6*

Art. 06 senza molla - *without spring*

Art. M6 con molla - *with spring*

Conformi alla Direttiva Europea 97/23/CE (PED)
Complying with European Directive 97/23/CE

Per impianti idrici, condizionamento, riscaldamento, applicazioni industriali ed agricole, aria ompressa
For chemical, food and industrial applications

CONDIZIONI DI IMPIEGO
CONDITION OF USE

TEMPERATURA/*TEMPERATURE*	**min °C**	**max °C**
NBR	-10	100
VITON	-20	150
PTFE	-20	200

PRESSIONE/*PRESSURE*	
Liquidi pericolosi - *Hazardous liquids* *	25 bar (DN32÷200) 16 bar (DN250÷300) 12 bar (DN350÷400)
Liquidi non pericolosi - *Non hazardous liquids* *	25 bar (DN32÷200) 16 bar (DN250÷400)
Gas non pericolosi - *Non hazardous gases* *	25 bar (DN32÷200) 16 bar (DN250÷400)

* Secondo/*according to*: 97/23/CE - 67/548/EEC

INSTALLAZIONE
INSTALLATION

-Maneggiare con cura.
-Montare nel senso corretto.
-Evitare colpi d'ariete che possono provocare danni irreparabili.
-In caso di utilizzo con fluidi a temperatura elevata prestare attenzione al rischio di ustioni al contatto.
-Non smontare o eseguire interventi di manutenzione con impianto in pressione.
-Utilizzare il foro "O" per l'imbragatura- sollevamento.

Montaggio: avvicinare le controflange lasciando un gioco G adeguato al montaggio della valvola. Posizionare un bullone in uno dei fori inferiori delle flange (1) in corrispondenza delle alette presenti sul lato della valvola e posizionare la valvola appoggiando sul bullone una delle alette (2). Montare i restante i bulloni e serrarli a croce.

-Handle with care.
-Mount in the correct sense.
-Avoid pressure shock that can cause irreparable damages.
-Use hole "O" for the lifting.
-In case of use with hot fluids pay attention to the risk of scald.
-Do not dismantle or execute maintenance with pressure in the plant.

Mounting: draw near the flanges leaving a space G suitable for the mounting. Position a bolt in one of the inferior holes of the flange (1) corresponding to the tongue on the side of the valve and position the valve leaning one of the tongue the bolt.

STOCCAGGIO
STORING

Conservare in luogo asciutto
Keep in a dry and cold place

fig. 1

MANUALE D'USO E MANUTENZIONE
MAINTENANCE AND USE HANDBOOK
INSTALACIÓN Y MANTENIMIENTO

CE 1115

VALVOLE A FARFALLA
BUTTERFLY VALVES
VÁLVULAS DE MARIPOSA

SERIE 09 - *SERIES 09* - SERIE 09

Art. J9 WFER — Art. L9 LUG — Art. F9

Conformi alla Direttiva Europea 97/23/CE (PED)
Complying with European Directive 97/23/CE
Conforme a 97/23/CE (PED)

Per impianti idrici, riscaldamento, condizionamento, antincendio e gas. Non adatta per vapore. In caso di utilizzi particolari richiedere al produttore la compatibilità con l'applicazione.
For water systems, heating, conditioning, fire prevention and gas. Not suitable for steam. For specific uses ask the manufacturer about product compatibility.
Para sistemas de agua, aire acondicionado, calefacción, anti-incendio y gas. Usos industriales, químicos y alimentación. Consultar listado de fluidos. No válido para vapores.

Headquarters: Via Novara, 199 - 28078 **Romagnano Sesia** (No) ITALY
Tel. +39.0163.828.111 - Fax. +39.0163.828.130

E-mail: info@brandoni.it
Internet: www.brandoni.it
P. IVA/VAT NUMBER 00113680037

REV. 11-06-2009

CONDIZIONI DI IMPIEGO
CONDITION OF USE
CONDICIONES DE USO

TEMPERATURA *TEMPERATURE* TEMPERATURA	min °C	max °C
NBR	-10	80
EPDM	-10	120
VITON	-10	140
PTFE	-10	120

Pressione massima / *Maximum allowable pressure*		
Tipo fluido per / *Fluid type acc. to 97/23/CE - 67/548/EEC*	**Montaggio** / *Mounting*	
	tra flange / *between flange*	**fine linea** / *end of line*
G1 Gas pericolosi Hazardous gases	16 bar DN25-200 10 bar DN250-350 **NO DN400-1000**	10 bar DN25-100 **NO DN125-1000**
G2 Gas non pericolosi Non hazardous gases	16 bar DN25-300 10 bar DN350-500 6 bar DN600-800 5 bar DN900-1000	10 bar DN25-300 6 bar DN350-500 4 bar DN600-800 3 bar DN900-1000
L1 Liquidi pericolosi Hazardous liquids	16 bar DN25-400 10 bar DN450-1000	10 bar DN25-400 6 bar DN450-1000
L2 Liquidi non pericolosi Non hazardous liquids	16 bar DN25-400 10 bar DN450-1000	10 bar DN25-400 6 bar DN450-1000

AVVERTENZE
WARNING
ADVERTENCIA IMPORTANTE

Prima di procedere a qualunque intervento di manutenzione o smontaggio: attendere il raffreddamento di tubazioni, valvola e fluido, scaricare la pressione e drenare linea e tubazioni in presenza di fluidi tossici, corrosivi, infiammabili o caustici.
Temperature oltre i 50°C e sotto gli 0° C possono a causare danni alle persone.
Before to proceed in any intervention of maintenance or disassembly: wait the cooling of the piping, the valve and the fluid, let the pressure escape and drain line and piping in the presence of poisonous, corrosive, inflammable and caustic fluids.
Temperature over 50°C and under 0° C can cause damages to people.
Antes de proceder a cualquier intervención de mantenimiento o desmontaje: esperar el enfriamiento de la tubería, válvula y fluido, descargar la presión y drenar la linea de tubería con la presencia de fluidos tóxicos, corrosivos, inflamables o caústicos.
Temperaturas por encima de 50°C y por debajo de 0° C pueden causar daños personales.

INSTALLAZIONE
INSTALLATION
INSTALLAZIONE

Evitare inclinazioni, torsioni e disallineamenti delle tubazioni che possono sollecitare la valvola una volta installata.
Non utilizzare le parti più deboli (maniglia, volantino) per sollevare la valvola Il disco della valvola deve essere in posizione semiaperta (Fig. 1).
Piazzare la valvola tra due flange. Assicurarsi che, durante il posizionamento della valvola tra le flange, ci sia sufficiente spazio da non danneggiare la gomma. Non montare guarnizioni tra valvole e flangia (Fig. 2).
Evitare parti di tubi sporgenti e affilati poiché causano danni sulle superfici di gomma delle valvole (Fig. 3).
Non installare la valvola a farfalla a contatto diretto con una superficie in gomma (es. Giunti elastici); l'installazione ottimale richiede un contatto gomma su metallo (Fig. 4).
Non saldare le flange al tubo quando la valvola è già installata Raccomandiamo di usare le flange del tipo a collarino (Fig 5A).
Quando si utilizzano flange piatte assicurarsi che siano saldate esattamente a filo della flangia (Fig. 5B).

STOCCAGGIO E TRASPORTO
STORING AND TRANSPORTING
ALMACENAJE Y TRANSPORTE

-Maneggiare con cura.
-Conservare in ambiente chiuso e asciutto.
-Durante lo stoccaggio il disco della valvola deve essere in posizione semiaperta (Fig 1).
-Evitare urti, specialmente sulle parti più deboli (maniglia, volantino, riduttori / attuatori).
-Non utilizzare le parti più deboli (maniglia, volantino) per sollevare la valvola.
-Handle with care. Keep in a dry place.
-During the storage the valve disc must be half open (Fig 1).
- Avoid, especially on the most softest parts (handles, wheels, reducers / actuators).
-Do not use the most softest parts (handle, wheel) to lift the valve.
- Manejar con cuidado.
- Mantener en lugar seco y fresco.
- Durante el almacenaje el disco debe de mantenerse en posición semiabierta. (Fig 1)
- Evitar golpes, especialmente sobre las parte más débiles (palanca, reductor, volante, actuador).
- No utilizar las partes más débiles (palanca, volante) para manipular-transportar la válvula.

MANUTENZIONE
MAINTENANCE
MANTENIMIENTO

Non è richiesta manutenzione (non effettuare interventi).
No maintenance required (do not service).
No requiere de ningún tipo de mantenimiento especial.

Fig. 1

INSTALLAZIONE
INSTALLATION
INSTALACIÓN

Per le versioni Wafer centrare la valvola sugli occhielli. Serrare i bulloni a croce e progressivamente distribuendo uniformemente la pressione prima del contatto fra corpo e flangia (Fig. 6).
I colpi d'ariete possono causare danni e rotture. Raccomandiamo di evitarli o adottare giunti elastici per ridurne gli effetti.
Per la versione LUG, verificare che le viti d'installazione siano della giusta lunghezza, in modo da permettere la compressione completa della gomma manicotto "Liner".
La turbolenza del fluido può aumentare l'usura e ridurre la vita della valvola. Per ridurre il fenomeno si raccomanda di installare la valvola ad una distanza minima di almeno 1 volta il DN a monte e 2-3 DN a valle di raccordi e curve.
In posizione aperta la valvola presenta un ingombro maggiore dello scartamento nominale. Verificare che non vi siano interferenze con altri elementi della tubazione che possano provocare danni o malfunzionamenti (Fig. 7A). Nel caso installare un distanziale per consentire il corretto funzionamento (Fig. 7B).

Avoid inclinations, torques and non-alignments of the piping which could stress the valve once installed.
Do not use the softest parts (handle, wheel) to lift the valve.
The valve disc must be half open (Fig. 1).
Place the valve between two flanges. When placing valves between flanges, make sure that there is enough space not to damage rubber.
Do not install gaskets between valve and flanges. (Fig. 2).
Protruded sharp ends shall be strictly avoided as it causes damage on/off rubber seating surfaces of the butterfly valve (Fig. 3).
Do not install the butterfly valve on a rubber to rubber surface (e.g. expansion joints); the perfect installation shall be on rubber to metal surface (Fig. 4).
Do not place joints between flange and body - We recommend the use of flanges of the WELDING NECK type (Fig 5A).
When using flat flanges make sure the pipe is welded exactly edgewise with the flange (Fig. 5B).
Centre the valve by bolting the body locator first (Wafer type). Tighten bolts and nuts in progressive and crosswise with bolting pressure evenly distributed until the contact between valve body and flange faces (Fig. 6).
Pressure shocks can cause damages and breakage. We recommend to avoid them if possible or adopt expansion joints that could reduce pressure shocks' effects.
For the LUG type, please verify that the installation screws are of the right longness, in order to allow the complete compression of the liner rubber.
The fluid turbulence may increase the wear and reduce the valve endurance. In order to reduce the instance it is recommended to install the valve at a distance equal to at least 1 time the DN upstream and 2-3 DN downstream of fittings and bends.
In open position the valve shows a greater space occupied than the nominal face to face. You need to verify that there arenít interferences with other elements of the piping which could cause damages or malfunctions (Fig. 7A). In this case you need to set up a spacer to permit the right functioning (Fig. 7B).

Evitare inclinaciones, torsiones o disalinamientos de la tubería que puedan presionar a la valvula una vez instalada.
No utilizar las partes débiles (palanca, volante) para manipular-transporta la válvula.
El disco debe estar en posición semi-abierta (Fig. 1).
Situar la válvula entre dos bridas. Estar seguro que durante el posicionamiento de la válvula hay
suficiente espacio entre las bridas para evitar daños en el anillo. No instalar otros elementos o guarniciones entre válvula y bridas. (Fig. 2).
Los tubos pueden causar daños en la superficie del anillo (Fig. 3).
No instalar la válvula en contacto directo con una superficie de goma (por ejemplo: juntas de expansión). La instalación requiere un contacto metal-goma. (Fig. 4).
No soldar la brida al tubo si la válvula está ya instalada. Se recomienda usar bridas tipo WELDING NECK (Fig 5A).
Con bridas planas, asegurarse que la brida está soldada hasta el final de la misma (Fig. 5B).
Para la versión wafer centrar la válvula sobre las orejetas. Los bulones deben ser apretados en cruz distribuyendo uniformemente la presión después del contacto entre el cuerpo y las bridas (Fig. 6).
Los golpes de ariete pueden causar serios daños. Para evitarlos, se recomienda el uso de juntas de expansión para reducir los efectos del mismo.
Para la verión LUG, verificar que la tornillería utilizada tenga la largura justa, de modo que se permita la total compresión del anillo de cierre.
La turbolencia del fluido podría aumentar el desgaste y limitar la vida de la válvula. Para reducir el fenómeno se recomienda instalar la válvula a una distancia de una vez de DN, por lo menos, aguas arriba y de 2-3 DN aguas abajo de empalmes y curvas.
Al estar abierta la válvula ocupa un espacio mayor que el de la anchura nominal. Comprueben que no hayan interferencias con otros elementos de la tubería que pudieran provocar daños o funcionamientos defectuosos (Fig. 7A). En tal caso habrá que instalar un distanciador para permitir un fucinamiento correcto (Fig. 7B).

Fig. 2

Fig. 4

Fig. 3

Fig. 5

Fig. 6

Fig. 7

LV 9912

Lugged or Wafer Butterfly Valve - EPDM Liner

WRAS

Epoxy Coated Ductile Iron Body, Stainless Steel 316 Disc, EPDM Liner, Locking Lever upto 12", Gearbox Operation Available for All Sizes, ISO 5211 Top Works for Direct Mount of Electric/Pneumatic Actuator, complies with 97/23/CE (PED) Directive CE 1115.

1½" to 12" to fit PN16, Other drillings available
14" to 24" to fit PN16 Flanges

* ALSO OFFER ANSI ISO, SAME DIMENSION OF VALVE AS LISTED FOR PN16 *

Pressure/Temperature		
Pressure	1½" to 12"	PN16
	14" to 24"	PN10
Temperature	-10°C to 120°C	

Material List		
Body	Epoxy Coated Ductile Iron	
Disc	Stainless Steel	
Liner	EPDM	
Shaft	Stainless Steel	
Bushing	PTFE	
Washer	Galvanized Carbon Steel	
Circlip ISO 3075	Steel	
O-Ring	Viton	
Lever	Aluminium upto 6"	Ductile Iron 8" and above
Bolts	Galvanized Carbon Steel	

Operating Torque Figures

DP (Bar)	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
3	2.9	4.7	7.8	11.3	17	23	33	48	68	120	189	290	298	481	930	1250	2270
6	3.1	5.1	8.4	12	18	25	36	54	78	134	212	316	347	551	980	1350	2500
10	3.3	5.4	8.8	13	20	26	40	61	88	148	234	342	396	396	1200	1500	2700
16	3.4	5.7	9.2	13	21	28	44	68	99	162	257	367	-	-	-	-	-

Continued on Page 2

1½″ to 10″ Lever Operated

Dimensions									
Size	A	ØC	D	B	F1	Z	R	Ø mm pipe	n° x M
1½″	33	82	116	63	170	50	5	27	4 x M16
2″	43	89	126	62	170	50	5	31	4 x M16
2½″	46	102	136	69	170	50	9	45	4 x M16
3″	46	118	150	90	206	69	17	65	8 x M16
4″	52	150	170	106	206	69	26	90	8 x M16
5″	56	174	180	119	285	90	34	110	8 x M16
6″	56	205	200	131	285	90	50	146	8 x M20
8″	60	260	230	166	400	72	71	194	12 x M20
10″	68	318	266	202	530	72	91	241	12 x M24

Dimensions						
Size	ISO	ØG	ØJ	n x Øq	□S	E
1½″	F05	65	50	4 x 7	9	21
2″	F05	65	50	4 x 7	9	21
2½″	F05	65	50	4 x 7	9	21
3″	F05	65	50	4 x 7	11	21
4″	F05	65	50	4 x 7	11	21
5″	F07	90	70	4 x 9	14	27
6″	F07	90	70	4 x 9	14	27
8″	F10	125	102	4 x 11	17	27
10″	F12	150	125	4 x 13	27	27

Continued on Page 3

Lugged Wafer Butterfly Valve - EPDM Liner

WRAS

1½″ to 10″ Gearbox Operated

Dimensions

Size	A	ØC	D	B	F2	L	T	L1	L2	W	ØO	R	Ø min pipe	n° x M
1½″	33	82	116	63	130	102.5	65	110	130	45	150	5	27	4 x M16
2″	43	89	126	62	130	102.5	65	110	130	45	150	5	31	4 x M16
2½″	46	102	136	69	130	102.5	65	110	130	45	150	9	45	4 x M16
3″	46	118	150	90	130	102.5	65	110	130	45	150	17	65	8 x M16
4″	52	150	170	106	130	102.5	65	110	130	45	150	26	90	8 x M16
5″	56	174	180	119	130	102.5	65	110	130	45	150	34	110	8 x M16
6″	56	205	200	131	130	102.5	65	110	130	45	150	50	146	8 x M20
8″	60	260	230	166	235	190	78	155	176	63	300	71	194	12 x M20
10″	68	318	266	202	226	190	80	170	195	81	300	91	241	24 x M20

Dimensions

Size	ISO	ØG	ØJ	n x Øa	□S	E
1½″	F05	65	50	4 x 7	9	21
2″	F05	65	50	4 x 7	9	21
2½″	F05	65	50	4 x 7	9	21
3″	F05	65	50	4 x 7	11	21
4″	F05	65	50	4 x 7	11	21
5″	F07	90	70	4 x 9	14	27
6″	F07	90	70	4 x 9	14	27
8″	F10	125	102	4 x 11	17	27
10″	F12	150	125	4 x 13	27	27

Continued on Page 4

WRAS

12″ to 24″ Gearbox Operated

Dimensions														
Size	A	ØC	D	B	F2	L	T	L1	L2	W	ØO	R	Ø min pipe	n° x M
12″	78	376	292	235	226	190	80	170	195	81	300	112	291	12 x M24
14″	78	406	335	257	226	183	80	151	188	80	285	128	324	16 x M24
16″	102	471	360	292	226	183	80	151	188	80	285	144	379	16 x M24
18″	114	539	422	318	216	183	80	151	188	80	285	163	428	20 x M24
20″	127	594	480	355	256	311	125	214	275	168	285	182	475	20 x M24
24″	154	695	562	444	285	386	136	262	324	293	385	219	573	20 x M27

DN25-300

DN350-600

Parallel key ISO R773 / DIN6885A

Dimensions							
Size	ISO	ØG	Øj	n x Øq	□S	E	ØS
12″	F12	150	125	4 x 13	27	27	
14″	F12	150	125	4 x 13		45	31.6
16″	F14	175	140	4 x 18		51.2	33.15
18″	F14	175	140	4 x 18		51.2	38
20″	F14	175	140	4 x 18		64.2	41.15
24″	F16	210	165	4 x 22		70.2	50.65

Multi-Flanged Wafer Pattern Butterfly Valve - EPDM Liner

WRAS

Epoxy Coated Ductile Iron Body, Stainless Steel 316 Disc, EPDM Liner, Locking Lever upto 12", Gearbox Operation Available for All Sizes, ISO 5211 Top Works for Direct Mount of Electric/Pneumatic Actuator, complies with 97/23/CE (PED) Directive CE 1115.

1½" to 16" to fit PN6/10/16, ANSI 150, Table D & E Flanges
18 to 24" to fit PN16 Flanges

Pressure/Temperature		
Pressure	1½" to 12"	PN16
	14" to 24"	PN10
Temperature	-10°C to 120°C	

Material List	
Body	Epoxy Coated Ductile Iron
Disc	Stainless Steel
Liner	EPDM
Shaft	Stainless Steel
Bushing	PTFE
Washer	Galvanized Carbon Steel
Circlip ISO 3075	Steel
O-Ring	Viton
Lever	Aluminium upto 6" Ductile Iron 8" and above
Bolts	Galvanized Carbon Steel

Operating Torque Figures																	
DP (Bar)	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
3	2.9	4.7	7.8	11.3	17	23	33	48	68	120	189	290	298	481	930	1250	2270
6	3.1	5.1	8.4	12	18	25	36	54	78	134	212	316	347	551	980	1350	2500
10	3.3	5.4	8.8	13	20	26	40	61	88	148	234	342	396	396	1200	1500	2700
16	3.4	5.7	9.2	13	21	28	44	68	99	162	257	367	-	-	-	-	-

Continued on Page 2

1½″ to 10″ Lever Operated

Dimensions								
Size	A	ØC	D	B	F1	Z	R	Ø min pipe
1½″	33	82	116	63	170	50	5	27
2″	43	89	126	62	170	50	5	31
2½″	46	102	136	69	170	50	9	45
3″	46	118	150	90	206	69	17	65
4″	52	150	170	106	206	69	26	90
5″	56	174	180	119	285	90	34	110
6″	56	205	200	131	285	90	50	146
8″	60	260	230	166	400	72	71	194
10″	68	318	266	202	530	72	91	241

Dimensions						
Size	ISO	ØG	ØJ	n x Øq	□S	E
1½″	F05	65	50	4 x 7	9	21
2″	F05	65	50	4 x 7	9	21
2½″	F05	65	50	4 x 7	9	21
3″	F05	65	50	4 x 7	11	21
4″	F05	65	50	4 x 7	11	21
5″	F07	90	70	4 x 9	14	27
6″	F07	90	70	4 x 9	14	27
8″	F10	125	102	4 x 11	17	27
10″	F12	150	125	4 x 13	27	27

Continued on Page 3

Double Flanged Water Pattern Butterfly Valve – EPDM Liner

WRAS

1½" to 10" Gearbox Operated

Dimensions													
Size	A	ØC	D	B	F2	L	T	L1	L2	W	ØO	R	Ø min pipe
1½"	33	82	116	63	170	102.5	65	110	130	45	150	5	27
2"	43	89	126	62	170	102.5	65	110	130	45	150	5	31
2½"	46	102	136	69	170	102.5	65	110	130	45	150	9	45
3"	46	118	150	90	170	102.5	65	110	130	45	150	17	65
4"	52	150	170	106	170	102.5	65	110	130	45	150	26	90
5"	56	174	180	119	170	102.5	65	110	130	45	150	34	110
6"	56	205	200	131	170	102.5	65	110	130	45	150	50	146
8"	60	260	230	166	235	190	78	155	176	63	300	71	194
10"	68	318	266	202	226	190	80	170	195	81	300	91	241

Dimensions						
Size	ISO	ØG	ØJ	n x Øq	□S	E
1½"	F05	65	50	4 x 7	9	21
2"	F05	65	50	4 x 7	9	21
2½"	F05	65	50	4 x 7	9	21
3"	F05	65	50	4 x 7	11	21
4"	F05	65	50	4 x 7	11	21
5"	F07	90	70	4 x 9	14	27
6"	F07	90	70	4 x 9	14	27
8"	F10	125	102	4 x 11	17	27
10"	F12	150	125	4 x 13	27	27

Continued on Page 4

12″ to 24″ Gearbox Operated

Dimensions													
Size	A	ØC	D	B	F2	E	T	E1	L2	W	ØO	R	Ø min pipe
12″	78	376	292	235	226	190	80	170	195	81	300	112	291
14″	78	406	335	257	226	190	80	170	195	81	300	128	324
16″	102	471	360	292	226	190	80	170	195	81	300	144	379
18″	114	539	422	318	216	183	80	151	188	80	285	163	428
20″	127	594	480	355	256	311	125	214	275	168	285	182	475
24″	154	695	562	444	285	386	136	262	324	293	385	219	573

DN25-400

Parallel key ISO R773 / DIN6885A

DN450-600

Dimensions							
Size	ISO	ØG	Øj	n x Øq	□S	E	ØS
12″	F12	150	125	4 x 13	27	27	
14″	F12	150	125	4 x 13	27	27	
16″	F12	150	125	4 x 13	27	27	
18″	F14	175	140	4 x 18		51.2	38
20″	F14	175	140	4 x 18		64.2	41.15
24″	F16	210	165	4 x 22		70.2	50.65

Stainless Steel Spring Check Valve (Wafer Type)

To fit PN6/10/16/25, ANSI 150 Flanges, Stainless Steel Body, Disc & Spring

Pressure/Temperature Ratings		
Pressure	PN25	
Temperature	NBR	-20°C to 100°C
	Viton	-20°C to 150°C
	PTFE	-20°C to 200°C

Dimensions							
DN	P	A	C	H	H1	Q	Kg
32	20	16	77	83.5	45	18	0.43
40	26.5	16	86.5	88.75	49	21	0.54
50	33	18.5	99	98.5	53	30	0.82
65	43	18.5	118	107	63	44	1.25
80	53	22	134	115	73	56	1.83
100	75	23.5	154	131	92	70	2.42
125	96	29	184	138	119	80	3.1
150	118	34.5	208	137	149	96	5.3
200	164	36	264	169	167	125	8.5

Material List		
1.	Body	ASTM A351 gr. CF8M
2.	Disc	ASTM A351 gr. CF8M
3.	Plate	ASTM A351 gr. CF8M
5.	O-ring	NBR/Viton/PTFE
6.	Spring	AISI 302
8.	Screw	Stainless Steel A2

Stainless Steel Spring Check Valve (Wafer Type)

Head loss

Fluid: water (1m H2O = 0,098bar)

Kv									
DN	32	40	50	65	80	100	125	150	200
Kv	13	24	41	75	140	208	341	525	1093

Cracking Pressure (mmH2O)									(1m H2O = 0,098bar)
DN	32	40	50	65	80	100	125	150	200
With Spring ↑	321	210	194	198	196	174	226	230	244
With Spring →	242	138	126	130	120	106	126	130	136
Without Spring ↑	80	73	70	70	76	68	100	100	110

H
Certifications

This appendix contains the test certificates and certification for the system.

Job Test Certificate

SOP 30216 Job ID 1527 PO 11817CN3217EB Aqua Cooling Solutions Ltd

1 X SS.CVA-250 250mm Microbubble (de-aerator) Air Separator- Stainless

How Tested:Tested with air @ 21 Bar

Date Tested: 13 / 08 / 2015

Tested By (full name) : Liam Keeley **Sign**

Witnessed By (full name) : Joe Haychore **Sign** J. Haychore

TESTED
Tested with air @ 21 Bar
OK PASSED
Fabricated Products UK Ltd

Job Test Certificate

SOP 31571 Job ID 1534 PO 11858CN3194MLH Aqua Cooling Solutions Ltd

1 X SS.CVA-200 200mm Microbubble (de-aerator) Air Separator- Stainless 25mm top & Bottom conection

How Tested:Tested with air @ 21 Bar

Date Tested:13 / 08 / 15

Tested By (full name) : Joe Haycrose **Sign.**J. Haycrose

Witnessed By (full name) : Steven Gar **Sign.**

TESTED
Tested with air @ 21 Bar
OK PASSED
Fabricated Products UK Ltd

Stanier Road , Portmarsh Industrial Estate
Calne , Wiltshire SN11 9PX.
Tel : 01249 813288 Fax : 01249 821266
Email : info@calne-engineering.co.uk
Internet : www.calne-engineering.co.uk

Calne Engineering Ltd

CERTIFICATE OF CONFORMITY

FM No.31808

TO: Aqua Cooling Solutions Ltd. Unit D4 Segensworth Business Centre Segensworth Road Fareham PO15 5RQ	**ORDER NO :**	**11815CN3217EB**
	WORKS NO :	**00037154**
	DEL. DATE :	**28/08/2015**
	DEL. NOTE NO :	**00032310**

QTY	DESCRIPTION	ADD. DESCRIPTION	DRAWING NO.	ISS.	REMARKS - TEST
4.000	CDU LPS 500 SP Frame.		L1060/3	1	

'CERTIFIED THAT THE SUPPLIES/SERVICES DETAILED HEREON HAVE BEEN INSPECTED & TESTED IN ACCORDANCE WITH THE CONDITIONS & REQUIREMENTS OF THE CONTRACT OR PURCHASE ORDER, & UNLESS QUOTED ABOVE CONFORM IN ALL RESPECTS TO THE SPECIFICATION(S), DRAWING(S) RELEVANT THERETO'

SIGNED: M.J.Humphreys
(QUALITY CONTROLLER)

All Products compliant to ROHS unless otherwise stipulated. (Zinc & Yellow , Zinc & Black & Chrome Plating is Not Compliant)