BCS Engineering, a.s.

DESIGN AND DELIVERY OF COMPLETE PLANTS

CHEMISTRY, PETROCHEMICAL AND POWER INDUSTRY, FOOD INDUSTRY, ENVIROMENTAL PROTECTION

# Unit for the Cultivation of Microalgae 18 $m^2$

## DETAIL DESIGN

## INSTRUMENTATION AND ELECTRICAL PART

Customer : **Zürich University of Applied Sciences ZHAW**

Location : Institute of Natural Resource Sciences IUNR
Grüental
CH-8820 Wädenswil
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# Specification of instruments

**CONTENT**

# 1. Field Instrumentation

## LISA 001 LEVEL OF SUSPENSION IN TANK

.01 **Name:** Screw-in Transmitter. Ceramic sensor, flush **1 pc**
**Description:**
Pressure in mH2O, Input: (mH2O) 1,0m, Output: 0…10V/3-wire, Accuracy: 0,35%, Electrical connection: Male and female plug ISO 4400(IP65), Mechanical connection: G1 1/2“ , Seals: FKM, Pressure port: Stainless steel 1.4571, Diaphragm: Ceramics Al2O3 96%, Special version: standard
**Range:** 0÷1 m is 0÷10 V
**Order No.:** LMK 351 471-1000-3-3-100-M00-1-1-2-000
**Manufactuer/Supplier:** BD SENSORS/JSP s.r.o.

## PIC 001 OUTPUT PRESSURE OF PUMP

.01 **Name:** Industrial Pressure Transmitter. Ceramic sensor, flush **1 pc**
**Description:**
Pressure gauge, Input: 0,6bar, Output: 0…10V/3-wire, Accuracy: 0,5%, Electrical connection: Male and female plug ISO 4400(IP65), Mechanical connection: G1/2“ DIN 3852, Seals: FKM, Pressure port: Stainless steel 1.4571, Diaphragm: Ceramics Al2O3 96%, Special version: standard
**Range:** 0÷60 kPa is 0÷10 V
**Order No.:** DMK 331 250-6000-3-5-100-100-1-1-2-000
**Manufactuer/Supplier:** BD SENSORS/JSP s.r.o.

## LIC 002 LEVEL OF SUSPENSION ON PLATFORM

.01 **Name:** Ultrasonic sensor **1 pc**
**Description:**
Ultrasonic sensor, Output: 4…20mA, Accuracy: ±0,5%, Connection: V1 connector(M12x1) 4-pin, Mechanical connection: M12x1, Material: brass, nickel-plated, Transducer: epoxy resin/hollow glass sphere mixture; foam polyurethane, cover PBT
**Sensing Range:** 15…120 mm
**Adjustment Range:** 20…120 mm
**Order No.:** UB120-12GM-I-V1 (038310)
**Manufactuer/Supplier:** PEPPERL+FUCHS/ PEPPERL+FUCHS

.02 **Name:** Connector V1 with cable **1 pc**
**Description:**
Female connector M12, Protection degree: IP67, Cable lenght: 10m
**Cable lenght:** 10 m
**Order No.:** V1-G-10M-PVC
**Manufactuer/Supplier:** PEPPERL+FUCHS/ PEPPERL+FUCHS

**QIC 001 pCO2**

.01 **Name:** Dissolved carbon dioxide sensor **1 pc**
**Description:**
Lower detection limit 10mbar, Accuracy: ±10%($pCO_2$ 10 to 900mbar), ±15%($pCO_2$ > 900mbar), Response time: 90% of final value < 120 sec at 25°C, Measuring principle: Potentiometric Severinghaus, Cable connection: VP(IP68), Conector design: straight, Sensor body: 316L stainless steel, Membrane material: silicone(reinforced with steel mesh), Surface roughness of wetted parts: N5($R_a$=0,4μin/16μin), O-ring material: Viton, silicone(FDA compliant), Sensor diameter: 12mm, Temperature compensation: Automatic, Temperature sensor: Pt1000, Measuring temperature range: 0 to 60°C, Sterilization temperature: ≤130°C, Measuring pressure resistance: 0,2 to 2 bar, Mechanical pressure resistance: 3 bar at 25°C
**Measuring range:** 10…1000 mbar $CO_2$
**Order No.:** InPro5000i/12/120 (30013606)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.02 **Name:** Connector AK9 with cable **1 pc**
**Description:**
Female connector, Protection degree: IP68, Cable lenght: 5m
**Cable lenght:** 5 m
**Order No.:** AK9/5m (59902213)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.03 **Name:** Housing **1 pc**
**Description:**
Wetted parts: Stainless 316L, Surface finish(O-ring groove/Other): N5/N5($R_a$ 16/Ra 16), O-ring: Silicone-FDA-USP VI, Sensor fitting: Pg 13,5, Temperature range: 0-140°C, Pressure rating: Max. 16bar
**Order No.:** InFit761/WS/0070/4435/D00/Si9-
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.04 **Name:** Transmitter M400 **1 pc**
**Description:**
Power supply: 100 to 240 V AC or 20 to 30 V DC, Frequency for AC: 50 to 60Hz, Current output: 4x0/4 to 20 mA, 22mA alarm, Service interface: USB, Display: Backlit LCD, 4 lines, Languages: 8, Ambient temperature: -10 to 50°C, Relative humidity: 0 to 95% non-condensing, Rating/Approvals: IP65, PID process controller: Yes, Hold input: Yes, Control input: yes, Alarm contact: Yes, Measurement parameters: D.O. saturation or concentration and temperature, ISM: Plug&Measure, Advanced Diagnostics (Lifetime indicator, Adaptive calibration timer, CIP/SIP counter etc.), Measuring current (Air): 25 to 130 nA at 25°C, D.O. saturation range: 0 to 500%, D.O. concentration range: 0,00 to 20,00 ppm, Measurement error: ±0,5% of full scale reading, Measurement resolution: 30pA, Temperature input: NTC 22kΩ, Temperature compensation: Automatic, Temperature measuring range: -10 to 80°C, Calibration: 1-point (slope or offset calibration), process calibration (slope or offset calibration)
**Order No.:** M400 Type 3 (52121350)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

**QI 002 pH**
**TI 001 TEMPERATURE OF SUSPENSION**

.01 **Name:** ISM pH sensor with sterilization resistant glass **1 pc**
**Description:**
Plug head: AK9(IP68), Pg 13,5, Shaft diameter: 12mm, Temperature sensor: Pt1000, Measuring temperature range: 0 to 100°C, Sterilization temperature: ≤140°C, Pressure: 0 to 4 barg, Reference systém: Argenthal with silver-ion trap, Type of junction: Ceramic, Reference electrolyte: Pre-pressurized liquid, Lenght: 120mm, Sterilizable: Yes, Autoclavable: Yes
**pH range:** 0-12 pH
**Order No.:** InPro3253i/SG/120 (52005377)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.02 **Name:** Connector AK9 with cable **1 pc**
**Description:**
Female connector, Protection degree: IP68, Cable lenght: 5m
**Cable lenght:** 5 m
**Order No.:** AK9/5m (59902213)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.03 **Name:** Housing **1 pc**
**Description:**
Wetted parts: Stainless 316L, Surface finish(O-ring groove/Other): N5/N5($R_a$ 16/Ra 16), O-ring: Silicone-FDA-USP VI, Sensor fitting: Pg 13,5, Temperature range: 0-140°C, Pressure rating: Max. 16bar
**Order No.:** InFit761/WS/0070/4435/D00/Si9-
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.04 **Name:** Transmitter M300 ISM 1 Channel Multi 1/2DIN, wall **1 pc**
**Description:**
Power supply: 100 to 240 V AC or 20 to 30 V DC, Frequency for AC: 50 to 60Hz, Current output: 2x0/4 to 20 mA, 22mA alarm, Service interface: USB, Display: Backlit LCD, 4 lines, Languages: 8, Ambient temperature: -10 to 50°C, Relative humidity: 0 to 95% non-condensing, Rating/Approvals: IP65, PID process controller: Yes, Hold input: Yes, Control input: yes, Alarm contact: Yes, M300 for ISM: “Plug and Measure“ feature, Measurement parameters: pH, mV and temperature, pH display range: -1 to 15 pH, Resolution: 0,01 pH, 1mV, Relative accuracy: ±0,03% pH, ±2 mV, Temperature input: PT1000, Temperature compensation: Automatic/manual, Temperature measuring range: -30 to 150°C, Temperature resolution: 0,1°C, Temperature measurement error: ±0,25°C, Calibration: 1 or 2 point calibration, process calibration
**Order No.:** M300 ISM 1 Channel Multi 1/2DIN, wall (52121355)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

**QI 003 O2**

.01 **Name:** Optical oxigen sensor **1 pc**
**Description:**
Accuracy: ≤ ±[1%+8ppb], Response time at 25°C: 98% of final value < 70 sec, Measuring principle: Optical, Cable connection: VP8(IP68), Sensor body: 316L stainless steel, $O_2$ selective membrane material: PTFE/silicone, Surface roughness of wetted parts: N5($R_a$=0,4μin/16μin), Wetted sensor parts: PTFE, Wetted O-rings: EPDM, Sensor diameter: 12mm, Measuring temperature range: 5 to 60°C, Mechanical temperature resistance: -20 to 140°C, Measuring pressure resistance: 0,2 to 6 bar, Mechanical pressure resistance: Maximum 6 bar
**Operating range:** 8 ppb to 60% $O_2$ saturation
**Order No.:** InPro6860i/12/120 (30014100)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.02 **Name:** Connector VP8 with cable **1 pc**
**Description:**
Female connector, Protection degree: IP68, Cable lenght: 5m
**Cable lenght:** 5 m
**Order No.:** VP8-ST/5m (52300355)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.03 **Name:** Housing **1 pc**
**Description:**
Wetted parts: Stainless 316L, Surface finish(O-ring groove/Other): N5/N5($R_a$ 16/Ra 16), O-ring: Silicone-FDA-USP VI, Sensor fitting: Pg 13,5, Temperature range: 0-140°C, Pressure rating: Max. 16bar
**Order No.:** InFit761/WS/0070/4435/D00/Si9-
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

.04 **Name:** Transmitter M400 **1 pc**
**Description:**
Power supply: 100 to 240 V AC or 20 to 30 V DC, Frequency for AC: 50 to 60Hz, Current output: 4x0/4 to 20 mA, 22mA alarm, Service interface: USB, Display: Backlit LCD, 4 lines, Languages: 8, Ambient temperature: -10 to 50°C, Relative humidity: 0 to 95% non-condensing, Rating/Approvals: IP65, PID process controller: Yes, Hold input: Yes, Control input: yes, Alarm contact: Yes, Measurement parameters: D.O. saturation or concentration and temperature, ISM: Plug&Measure, Advanced Diagnostics (Lifetime indicator, Adaptive calibration timer, CIP/SIP counter etc.), Measuring current (Air): 25 to 130 nA at 25°C, D.O. saturation range: 0 to 500%, D.O. concentration range: 0,00 to 20,00 ppm, Measurement error: ±0,5% of full scale reading, Measurement resolution: 30pA, Temperature input: NTC 22kΩ, Temperature compensation: Automatic, Temperature measuring range: -10 to 80°C, Calibration: 1-point (slope or offset calibration), process calibration (slope or offset calibration)
**Order No.:** M400 Type 2 (52121349)
**Manufactuer/Supplier:** METTLER TOLEDO/ METTLER TOLEDO

**QI 004 TURBIDITY OF SUSPENSION**

.01 **Name:** Sensor of turbidity and solids SOLITAX inline sc **1 pc**
**Description:**
Measurement procedure: IR dual scatter light, Output: 4…20mA, Accuracy-turbidity: <1% or 0,001 FNU, Accuracy-solids: <5%, Respons time: 1-300 sec, Sample temperature: 0-40°C, Flow rate: 3m/s, Pressure range: 5bar, Weight: 2400g, Dimensions(DxL): 60x315mm, Housing: Stainless steel, Cleaning: with automatic wiper, Cable length: 10m, Type of fitting: Insertion probe
**Measuring range turbidity:** 0-4000 NTU
**Measuring range solids:** 0-50 g/l
**Order No.:** SOLITAX inline sc (LXV424.99.00100)
**Manufactuer/Supplier:** HACH LANGE/ HACH LANGE

.02 **Name:** Inline armatura **1 pc**
**Description:**
Material: Stainless steel
**Order No.:** LZX461
**Manufactuer/Supplier:** HACH LANGE / HACH LANGE

.03 **Name:** Welding flange **1 pc**
**Description:**
Material: Stainless steel
**Order No.:** LZX660
**Manufactuer/Supplier:** HACH LANGE / HACH LANGE

.04 **Name:** Transmitter SC200 **1 pc**
**Description:**
Power supply: 110-240/50 V/Hz, Current output: 2x0/4 to 20 mA, Display: Backlit LCD, Rating/Approvals: IP66
**Order No.:** LXV404.99.00501
**Manufactuer/Supplier:** HACH LANGE / HACH LANGE

**FIRC 001 FLOW OF CO2**
**FV 001 FLOW OF CO2**

.01 **Name:** Digital mass flow controller **1 pc**
**Description:**
Power supply: 24VDC, Accuracy: ±1,5% of full scale including linearity over 0-50°C and 0,3-10barg, Repeatability: ±0,25% of full scale, Temperature coefficient: 0,05% of full scale per °C, or better, Pressure coefficient: 0,15% of full scale per bar, or better, Response time: 300ms, Process connection: 3/8“, Output and setpoint signal: 4-20mA, Display: Yes, Material of body: stainless steel, Seal: Viton, Communication: RS232, Calibration: CO2, Electrical connection: Conector DB9
**Order No.:** C50 Series Smart-Trak®
**Manufactuer/Supplier:** SIERRA/ KROHNE

**FIC 002 FLOW OF SUSPENSION**

.01 **Name:** Electromagnetic flowmeter MAG 1100 **1 pc**
**Description:**
Measuring principe: Electromagnetic induction, Accuracy: 0,4%, Process connection: Wafer design-DN 50 mating flanges, Liner material: Ceramic Al2O3, Temperature of the medium: -20…150°C, Material electrodes: platinum, Housing material: polished stainless steel (AISI 316L), Protection degree: IP67
**Order No.:** 7ME6110-2YA20-2AA1
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.02 **Name:** Transmitter MAG 5000 **1 pc**
**Description:**
Power supply: 115…230V AC, Analog output: 4…20mA, Digital output: 1xrelay, 1xpulse output, Display: LCD, Accuracy: 0,4%, Ambient temperature-operation: -20…60°C, Housing material: fibre glass reinforced polyamide, Protection degree: IP67
**Order No.:** 7ME6910-1AA10-1AA0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

**FS 001 ELECTRIC MOTOR FOR MAIN VALVE**
**FS 002 ELECTRIC MOTOR FOR BYPASS VALVE**

.01 **Name:** Electric motor 2 **pc**
**Description:**
Power supply: 24V DC
**Order No.:** SM24A
**Manufactuer/Supplier:** BELIMO/ TRIVAL

**FIRC 003 FLOW WATER**

.01 **Name:** Ultrasonic flowmeter **1 pc**
**Description:**
Static ultrasonic water meter for accurate measuring and recording for all applications of water supply. Medium temperature range: 1…50°C, Ambient operating temperature: 1…70°C, Nominal pressure 16bar, Power supply: two 3,6 VDC lithium batteries, Battery lifetime: up to 16 years, Interfaces: two pulse output, Display: LCD-8digit, Unit: m3/h-l/h-m3-l-°C-F-h-d, Accuracy: higher than class D, Connection: DN20, G1“, Material: brass
**Nominal flow rate: 4** m3/h
**Order No.:** HYDRUS-Q3 4 DN20/130 G 1" R250 OM (3033693)
**Manufactuer/Supplier:** HYDROMETER/ ENBRA

**FS_003 SOLENOID VALVE FOR WATER TO TANK**
**FS_004 1. SOLENOID VALVE FOR GLASS CLEANING**
**FS_005 2. SOLENOID VALVE FOR GLASS CLEANING**
**FS_006 3. SOLENOID VALVE FOR GLASS CLEANING**
**FS_007 4. SOLENOID VALVE FOR GLASS CLEANING**

.01 **Name:** Solenoid valve 5 **pc**
**Description:**
Power supply 24 V DC
**Order No.:** 2VE25DA-N1
**Manufactuer/Supplier:** BELIMO/ TRIVAL

# 2. Control Cubicle

## A. Control cubicle

.01 **Name:** Control cubicle **1 pc**
**Description:**
Dimension(WxHxD): 800x1000x300 mm, Material: Stainless steel
**Order No.:** IRIS-LT 810.30
**Manufactuer/Supplier:** KM RACK/ KM RACK

## B. Control systém PLC

.01 **Name:** S7 MICRO MEMORY CARD, 128KB **1 pc**
**Description:**
SIMATIC S7, MICRO MEMORY CARD FUER S7-300/C7/ET 200, 3,3 V NFLASH, 128KBYTE
**Order No.:** 6ES7953-8LG20-0AA0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.02 **Name:** STARTER KIT TP1200 COMFORT **1 pc**
**Description:**
TP1200 COMFORT, WINCC COMFORT (TIA PORTAL)
**Order No.:** 6AV2181-4MB00-0AX0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.03 **Name:** CPU317-2 PN/DP, 1MB **1 pc**
**Description:**
SIMATIC S7-300 CPU 317-2 PN/DP, 1 MPI/DP 12MBIT/S, 2 ETHERNET PROFINET WITH 2 PORT SWITCH
**Order No.:** 6ES7317-2EK14-0AB0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.04 **Name:** Digital input/outpu module SM323 **1 pc**
**Description:**
16DI/16DO, DC 24V, 0,5A
**Order No.:** 6ES7323-1BL00-0AA0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.05 **Name:** Analog input module SM331 **1 pc**
**Description:**
8AI, 13BIT
**Order No.:** 6ES7331-1KF02-0AB0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.06 **Name:** Analog input/output module SM334 **1 pc**
**Description:**
4AI/2AO, 12BIT
**Order No.:** 6ES7334-1KE00-0AB0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.07 **Name:** SIMATIC S7-300 Rail **1 pc**
**Description:**
Rail L=480mm
**Order No.:** 6ES7390-1AE80-0AA0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.08 **Name:** Power Source SITOP PSU100L 24V/10A **1 pc**
**Description:**
INPUT: AC 120/230V, OUTPUT: DC 24V/10A
**Order No.:** 6EP1334-1LB00
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.09 **Name:** SIMATIC S7-300 Front connector 20pin **1 pc**
**Description:**
Front connector 20pin
**Order No.:** 6ES7392-1BJ00-0AA0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

.10 **Name:** SIMATIC S7-300 Front connector 40pin **2 pc**
**Description:**
Front connector 40pin
**Order No.:** 6ES7392-1BM00-0AA0
**Manufactuer/Supplier:** SIEMENS/ SIEMENS

## C. Other devices in control cubicle

.01 **Name:** General purpose AC drive **1 pc**
**Description:**
Power supply 200-240V ±10%, 48-62Hz
**Order No.:** Commander SK (SKA1200037)
**Manufactuer/Supplier:** CONTROL TECHNIQUES/ CONTROL TECHNIQUES

.02 **Name:** Relays -K1…-K8 **8 pc**
**Description:**
Relé Microseries 24VDC 1CO
**Order No.:** Commander Relé Microseries 24VDC 1CO (8533660000)
**Manufactuer/Supplier:** WEIDMÜLLER/ WEIDMÜLLER

.03 **Name:** Breakers -FA1…-FA7
**Description:**
-FA1- 10A C **1 pc**
-FA2, -FA6- 2A B **2 pc**
-FA3- 10A B **1 pc**
-FA4, FA7- 6A B **2 pc**
-FA5- 4A B **1 pc**
**Order No.:** MERLIN GERLIN
**Manufactuer/Supplier:** MERLIN GERLIN/ ELKOV

.04 **Name:** RESIDUAL CURRENT CIRCUIT BREAKERS WITH OVERCURRENT PROTECTION -FA8
**Description:**
-FA8- 10A B **1 pc**
**Order No.:** OLE-10B-1N-030AC (38314)
**Manufactuer/Supplier:** OEZ/ ELKOV

.05 **Name:** SURGE PROTECTION WITH CONNECTOR
**Description:**
-OF1- Type 3 arrester replacement connector (device protection) for 1-phase power supply networks with separate N and PE (3-conductor system: L1, N, PE).
Base element for protective plug PT, for mounting on NS 35/7.5 and NS 35/15, housing width: 17.5 mm
**Order No.:** PT2-PE/S-230AC-ST (2839347) **1 pc**
**Order No.:** PT-BE/FM (2839282) **1 pc**
**Manufactuer/Supplier:** PHOENIX CONTACT/ PHOENIX CONTACT

.06 **Name:** Main switch -Q1 **1 pc**
**Description:**
Cam switch 25A
**Order No.:** VSN25 1103A8-V-NVZ3R
**Manufactuer/Supplier:** OBZOR/ ELKOV

.07 **Name:** Compact Lamp with electrical swiss socket -H1 **1 pc**
**Description:**
Compact Lamp with electrical swiss socket
**Order No.:** KL 025 (02502.0-00)
**Manufactuer/Supplier:** STEGO/ GHV

.08 **Name:** Socket outlet -H2 **1 pc**
**Description:**
Socket outlet DIN (“SCHUKO“), Connection-bottom
**Order No.:** ZSF-03 (37292)
**Manufactuer/Supplier:** STEGO/ GHV

.09 **Name:** Transmitter **1 pc**
**Description:**
DIN Rail Housing, Connecting terminals removable, Loop powered 12 V DC ... 35 V DC, Input: 0 ... 20 mA/ 0 ... 10 V, Output: 4 ... 20 mA, 1 channel
**Order No.:** KFD0-CC-1 (038310)
**Manufactuer/Supplier:** PEPPERL+FUCHS/ PEPPERL+FUCHS

.10 **Name:** Terminals -X1…-X6
**Description:**
Terminals P-series, Feed-through terminal, Rated cross-section: 4 mm², PUSH IN
**Order No.:** PDU 2.5/4 (1896110000)
**Manufactuer/Supplier:** WEIDMÜLLER/ WEIDMÜLLER

# Unit for cultivation of microalgae – Electrical part

# 1. Technical report

## Content

## 1. Subject of the project

### 1.1 Electrical project contains:

the project solves the switchboard **CJK01** for control of platform for cultivation of microalgae. Further the project solves cable leads for the installed equipment.

### 1.2 Project documents:

customer requirements
mechanical engineering and technological drawings and documentation
regulations and valid standards for equipment placed in the building

## 2. Control system of instrumentation

Control system of the platform for cultivation of microalgae consists of control system PCL Simatic S7/300 located in the switchboard **CJK01**. All control takes place here. Monitoring of platform condition is carried out through local and remote devices and sensors. Obtained data are concentrated in control system PLC which evaluates and control platform operation by means of regulating loops. LPC program evaluates operational and emergency conditions and implements appropriate interventions. All signals, alarms and emergency conditions are transferred into the operator station and will be archived. Control program is stored in logic controller memory and after starting by an operator works fully autonomously. Operator station is placed at the door of the switchboard **CJK01**. As visualization software is used WinCC Flexible. Operator monitors operation of the platform on the screen. All measured values will be archived in the operation panel.

## 3. Review of regulation circuits needed for control of the platform

### 3.1 Supply of water in the tank

System of water level regulation is carried out by PLC logic. All control takes place here. Monitoring of water level height is carried out through a local water level probe LMK 351. The system evaluates critically low threshold water level at which the pump is switched off in order to prevent suction of air. Another threshold water level is operational. When through evaporation this level is reduced, the system automatically supplies water into the tank. Further is measured max. water level in the tank full of suspense.

### 3.2 Regulation of water level in the platform

Suspension level regulation on the platform is carried out by PLC control logic. Monitoring of suspension level on the platform is carried out through local level ultrasound probe UB 120-12GM-I-VI. The system evaluates the actual water level on the platform. Operator enters the desired height of water level in mm and the system regulates automatically the speed of the pump in order to achieve the required water level.

### 3.3 Regulation of pump speed

Regulation of pump speed is carried out by PCL control logic. Monitoring of pressure on the pump delivery is carried out through local pressure probe DMK 331. The system evaluates actual pressure at the pump delivery and regulates automatically the pump speed.

## 4. PLC control system

PLC control system Simatic S7/300 is selected from the range for fully integrated automation. It is a extensible compact microsystem with a simple programming for basic automation tasks with high degree of PLC functions and with a possibility to work separately or in the net applications. Programming is made by means of development environment Siemens Step 7. Control system modules are assembled on a common basic bar.
Extensibility enables adaptation for given specific solution. It has communication interface with protocol Profibus DP and the net communication Ethernet/Profinet. Communication speed is up to 12Mb/s on Profibus DP and 10/100 Mb/s on Ethernet/Profinet. Drives and remote controlled fittings are controlled through isolating relay. Control system PLC communicates with operator panel over the line Ethernet with protocol Profinet, for physical layer is used metallic cable.
Supply of inputs and outputs voltage is 24V DC.
Working conditions 0°C ÷ 55°C, storage temperature -40°C ÷ +70°C, relativ humidity 95% noncondensing.
Control system Simatic S7/300 is located in the switchboard **CJK01.**

## 5. Switchboard CJK01 of instrumentation and electric part

### 5.1 Switchboard execution

Switchboard of instrumentation and electrical part have a common cabinet. The switch board will be placed in the greenhouse, attached to the platform structure. Switchboard dimensions are HxWxD 1000x800x300 mm. Switchboard has wall stainless steel execution with cover IP 54/00. Outlets are made from the bottom. Switchboard is equipped with protection outlets designed to protect or disconnect feeding of circuits. Main switch of the switchboard is of a cam type with control lever on the site of the switchboard cabinet. Switchboard is equipped with circuit breakers, sockets, lighting and supply source 24VDC for control system PLC and field instrumentation. Switchboard feeding is made by connecting current supply from the switchboard provided by the customer. Supply voltage is 230 V/50 Hz is in the switchboard branched off for feeding the switchboard and individual parts of field instrumentation. Inlet feeding circuit must not be equipped with residual current circuit breaker with residual current ≤30mA due to possible ground leakage current of used frequency converter up to 20mA.

### 5.2 Overcurrent protection

Overcurrent protection of circuits and consumers will be performed by circuit breakers, which will be placed in switchboard.

## 5.3 Protection against overvoltage

Installed equipment and devices are of category III (4kV) according to EN 60664-1 requiring SPDT1. These SPDT1 are presumed to be located in power supply point of the customer.

## 5.4 El. energy consumption measuring

Consumption will be measured on the customer side.

## 5.5 Power factor correction

Power factor compensation of powered consumers within this project is not solved, it is presumed to be central in the power supply point.

## 5.6 Earthing and protection against electric shock

Within protection it is necessary to execute supplementary equipotential bonding of steel structure of the platform with protective earthing busbar of the switchboard **CJK01** by conductor CYA2,5.
Earthing terminal FM in the switchboard is necessary to connect by two parallel conductors according to assembly instruction of FM manufacturer.

| | |
|---|---|
| El. power supply system | 1 NPE ~ 50 Hz 230 V / TN-S<br>2 – 24 V/IT (for signaling and control) |
| Installed power: | 0,5 kW |
| Concurrent factor | 1,0 |
| Rated power | 0,5 kW |
| Power factor | 0,9 |

Protection against injury by el. shock according to CSN 61140 ed.2 and CSN 332000-4-4 ed.2:

1. Protective measure: automatic disconnection from the source according to 411 including:
   - BASIC PROTECTION (protection against dangerous touch of live parts) – by basic insulation and covers according to 411.2 and as per Annex A
   - FAULT PROTECTION (protection against dangerous touch of dead parts – by protective connection and automatic disconnection from the source by overcurrent protective elements according to 411.3 in the net 1 NPE ~ 50 Hz 230V/TN-S according to 411.4
   - ENHANCED PROTECTION – by additional connection and current protector as per 415

2. Protective measures: protection through low voltage according to 414 in the net 2 – 24V DC/SELV

Protection against electrical shock by EN 61140 and HD 60364-4-41:2007 :
1. Supply system 1 NPE ~ 230V 50Hz / TN-S:
Protection measure: automatic disconnection of supply taken in:

- BASIC PROTECTION (protection against direct contact) - basic insulation and enclosures
- FAULT PROTECTION (protection against indirect contact) - protective-equipotential-bonding and automatic disconnection of supply in the network TN-S
- ENHANCED PROTECTIVE - supplementary equipotential bonding, residual current circuit breakers

2. Supply 2 – 24V / IT:
- extra-low voltage SELV

Voltage in the control circuits of instrumentation is 24V DC, PELV, live parts are not connected with live parts of other circuits. Protection against dangerous touch with live and dead parts is by low voltage. Protection against dangerous touch with live parts is by insulation and covers. This protection is in control circuits of instrumentation. In power circuits is protection against overcurrents ensured by use of protective measures against overcurrents (circuits breakers in feeding switchboard, circuit breakers in control cabinets). Protection against dangerous touch with dead parts in power distribution is made by automatic disconnection from the source, insulation and connection.

Environment impacts:
HD 60364-5-51:2009 defines room in the building as:
Extra dangerous – environments: **AB6**, AD4, BC2 other A*x*1, B*x*1, C*x*1:

### 5.7 Directional marking of conductors

Sleeves at the end of conductors describe the place of connection:
*busbar terminal or device terminal*

## 6. Field instrumentation, used devices

### 6.1 Pressure measurement – continuous measurement

For pressure measurement is used sensor without programming for direct pressure measurement. Pressure sensor with outlet 0-10 V is connected directly to control system.

### 6.2 Water level measurement – continuous measurement of water level height in the tank

For continuous measurement of water level in the tank is used pressure sensor with outlet 0÷10 V which is directly connected to the control system.

### 6.3 Water level measurement – continuous measurement of water level height on the platform

For continuous measurement of suspension level on the platform is used ultrasound sensor with outlet 4-20 mA which is directly connected to the control system.

## 6.4 Measurement of algae suspension flow

For measurement of algae suspension flow is used induction flow meter with outlet 4-20 mA which is directly connected with the control system.

## 6.5 Measurement of $CO_2$ flow

For measurement of $CO_2$ flow is used thermal mass flow meter with regulator. Outlet 4-20 mA is directly connected with the control system.

## 6.6 Measurement of water flow

For measurement of water flow is used ultrasound water meter with two impulse outlets which is directly connected with the control system.

## 6.7 Temperature measurement

For temperature measurement is used resistance indicator Pt1000. Indicator forms a part of pH probe and is directly connected to the converter in the switchboard. Outlet 4-20 mA from the converter is directly connected to the control system.

## 6.8 pH, $O_2$, $pCO_2$ and turbidity measurement

For pH, $O_2$, $pCO_2$ and turbidity measurement are used special probes. The probes are directly connected to the converter in the switchboard. Outlets from the converter 4-20 mA are directly connected to the control system.

## 6.9 Action elements

Electric drives and solenoid valves are controlled through transmission relays. Electric drive of the pump is controlled through frequency converter.

# 7. Signal line of control system of cultivation platform

## 7.1 Cabling distribution

Cabling distribution of the control system of instrumentation will be executed in hot-dip galvanized cable channels, on cable racks, to individual devices in bundles or in galvanized pipes with correspondent corrosion resistance due to the environment or in plastic hoses. Cables are according to voltage level led separately in individual channels for:
routes for signals 24 V DC, 4-20 mA
routes for feeding and signals 230 V, 50 Hz

Main routes for signals 24 V DC, 4-20 mA are led in a separate cable channel parallel with routes 230 V , 50 Hz with min. distance 200 mm from these routes. Crossing of both routes is perpendicular. For feeding cabling is due to small number of cables for signals 230 V, 50 Hz presumed using of free cable racks or channels of electric part.

## 7.2 Directional marking of cables

Labels at the end of the cable are 4-lines and describe:
1. line – connection of remote end
line – cable name (KKS)
line – cable type
line – connection of close end

## 8. Energy consumption of control system of instrumentation and electric part:

Electricity

Electricity supply to the control system of instrumentation and field instrumentation:
1f. 230V, ~50 Hz, 1 kW

## 9. Requirements for other professions

**Mechanical engineering part**
Mechanical engineering part will ensure equipment connection of control system of instrumentation according to process flow sheet and drawings of withdrawals. It shall ensure welding of welded-on pieces of piping and holders for sensors. It shall also ensure execution of supports for bridging of great distances on steel structures for cable routes.

**Civil engineering part**
Within civil engineering works will be made passages through the wall for cable routes which will be after installation properly closed according to fire safety requirements.

## 10. Safety at work and health protection

Electrical installation must be executed in accordance with valid ČSN standards, must be attended and operated according to corresponding working and operational regulations of ČSN and manufacturer instructions in order to ensure safety at work and health protection and protection of property.

If electrical equipment and distributions are not properly handed or damaged there is danger of injury by electric shock. In order to prevent injury or fire is necessary to keep el. equipment and distributions in good technical condition and proceed in maintenance in accordance with the corresponding standards.

Operators must be made familiar with location and function of main switch. Attendance of el. equipment can be only carried out by persons with appropriate qualification.

Switchboard must be equipped with danger signs according to corresponding standards.
After installation the installer shall ensure initial inspection and elaboration of inspection report.

BCS Engineering, a.s.
Purkyňova 79a
Brno
+420 541 597 111

| | |
|---|---|
| Company / Customer: | Zürich University of Applied Sciences ZHAW |
| Project Number: | 1798 |
| Job number | 1798 DA5 001 |
| Final user: | Zürich University of Applied Sciences ZHAW |
| Type: | Control cubicle for unit for the Cultivation of Microalgae |

| | |
|---|---|
| Last edit date: | 20.12.2012 |
| Elaborated by: | Ing. Harašta |
| Revised by: | Ing. Kincl |
| Approved by: | Ing. Kostelník |

Number of pages 27

| Rev.No. | Description | Date | Name | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - COVER SHEET | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | 1798 Sheet 1 |
| | | | | Checked | Ing. Kincl | | | | Next 2 |
| | | | | Approval | Ing. Kostelník | | | | |

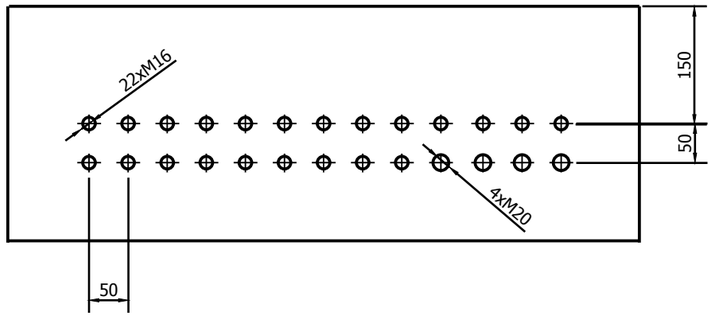
# CONTROL CUBICLE

# CJK01

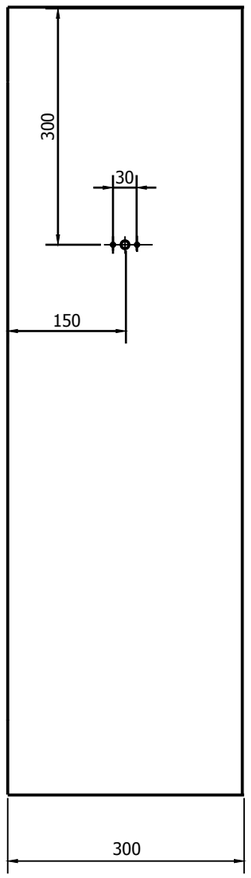
# CUBICLE DIMENSION AND LAYOUT

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - DIMENSION AND LAYOUT | 1798 DA5 001 | = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 | Sheet 2 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | | Next 3 |

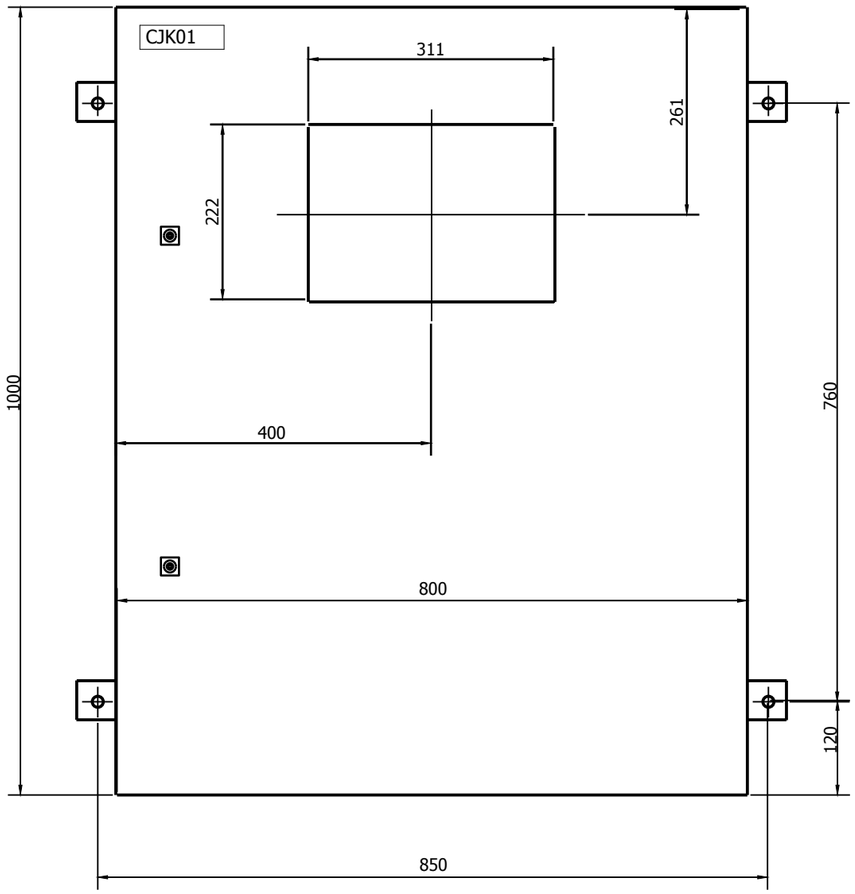
BOTTOM VIEW




RIGHT VIEW




FRONT VIEW




CONTROL SYSTEM CUBICLE 10CJJ10GH010 :

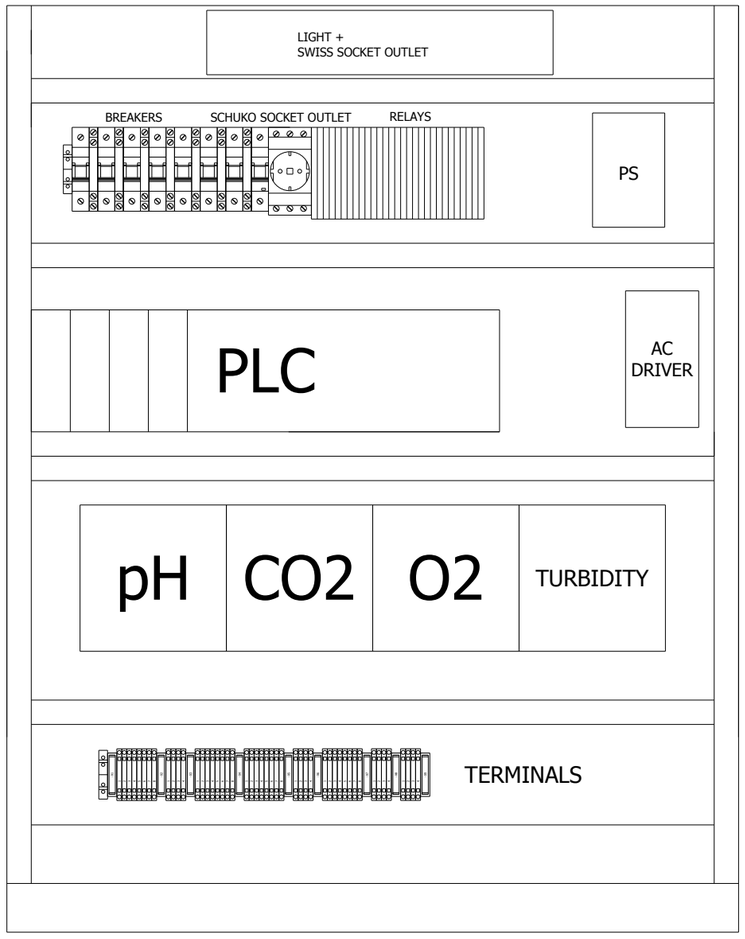
DIMENSIONS WxHxD: 800x1000x300 mm

MATERIAL: STAINLESS STEEL
COLOR: STAINLESS STEEL

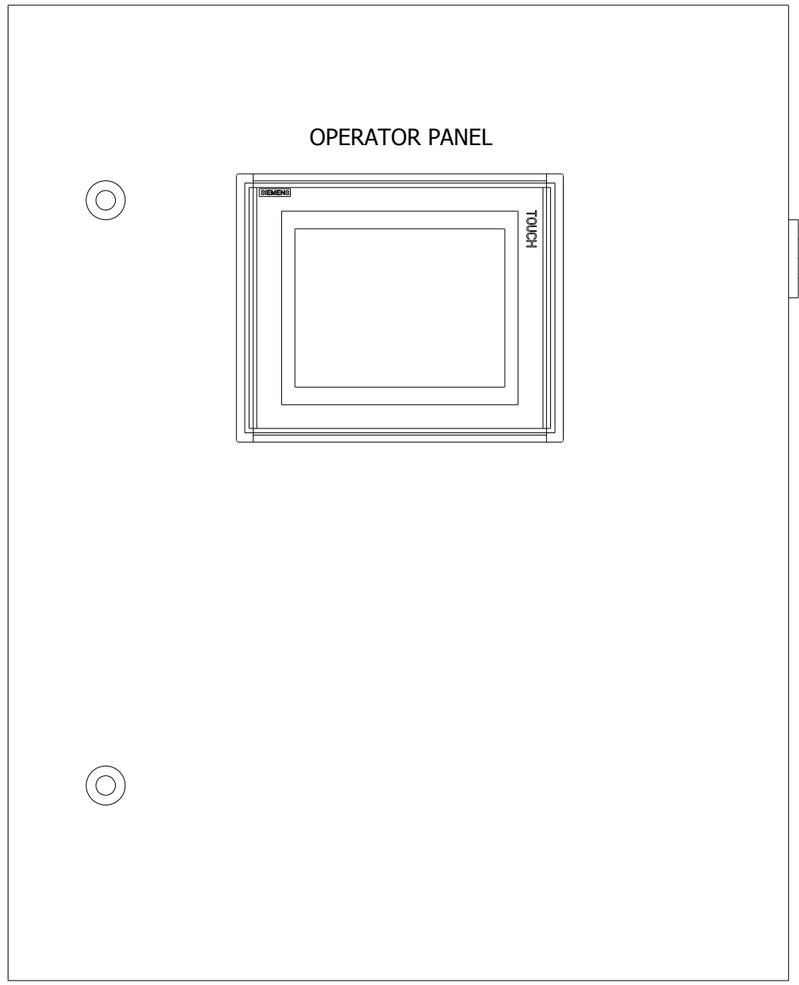
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - DIMENSIONS FOR MANUFACTURE | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 3 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 4 |

+CJK01

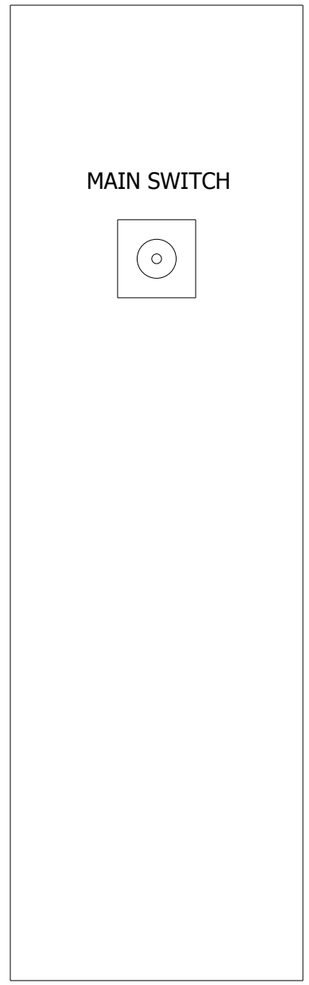
# MOUNTING PANEL




# FRONT VIEW




# RIGHT VIEW



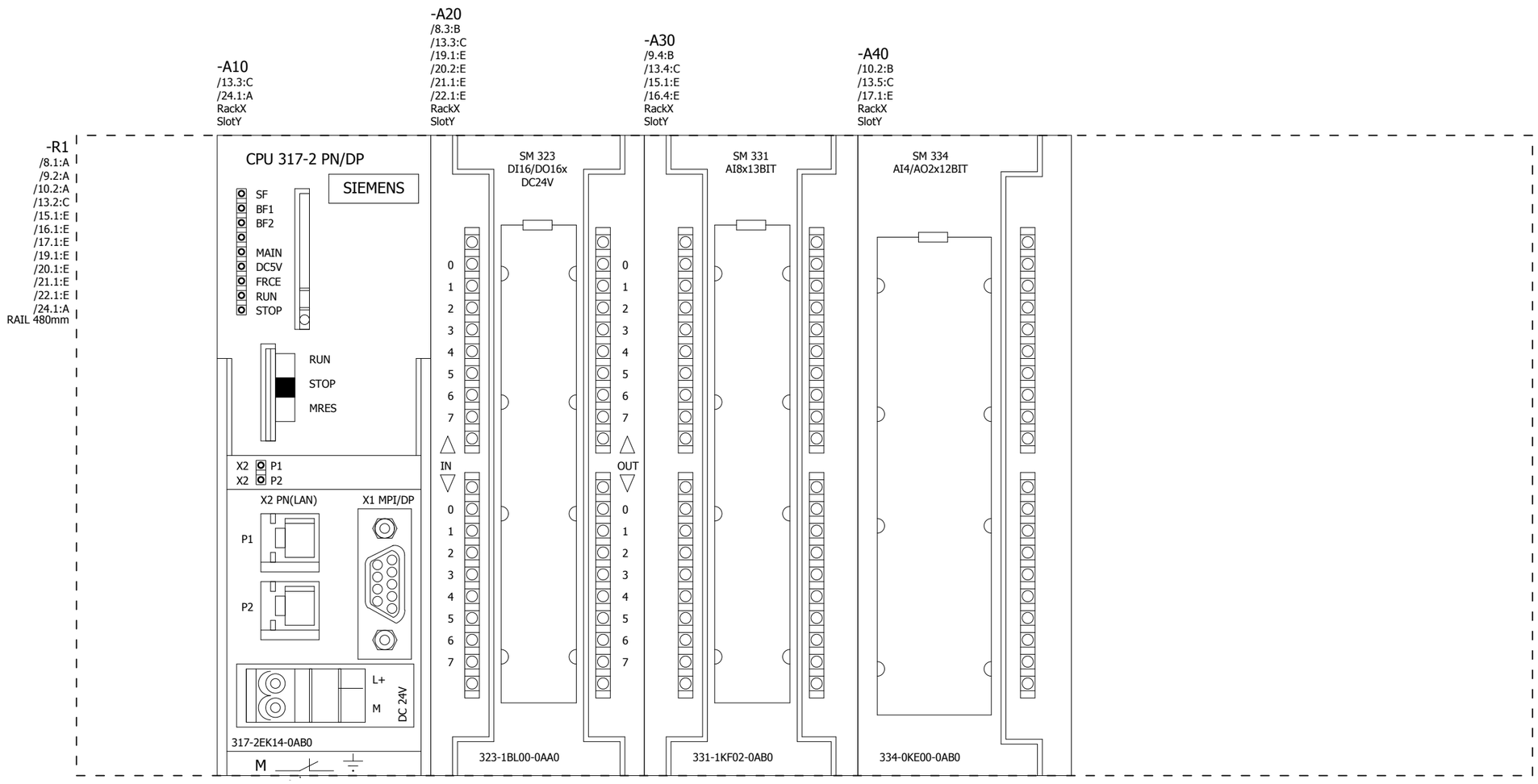

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - LAYOUT | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 4 Next 5 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | |

# CONTROL CUBICLE

# CJK01

# PLC CONFIGURATION

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - PLC CONFIGURATION | 1798 DA5 001 | = |
| | | | | Drawn | Ing. Harašta | | | | | +CJK01 |
| | | | | Checked | Ing. Kincl | | | | 1798 | Sheet 5 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | | Next 6 |




| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - RACK | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 6 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 7 |

# CONTROL CUBICLE

# CJK01

# WIRING I/O MODULES

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - WIRING I/O MODULES | 1798 DA5 001 | = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | 1798 | Sheet 7 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 8 |

-A20
/6.3:B
RackX
SlotY

SM 323
DI 16/DO 16 x DC 24V/0,5A

SIEMENS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | | | 21 | 2L+ | /13.4:D |
| PUMP RUN | -K10:11 | /22.5:E | 2 | I22.0 | Q112.4 | 22 | /21.2:E | -K3:A1 SOLENOID VALVE FOR WATER TO TANK |
| PUMP FAIL | -MCA_001:T5 | /22.5:E | 3 | I22.1 | Q112.5 | 23 | /21.3:E | -K4:A1 1. SOLENOID VALVE FOR GLASS CLEANING |
| pCO2-ALARM 1 | -QIC_001 | /19.2:E | 4 | I22.2 | Q112.6 | 24 | /21.4:E | -K5:A1 2. SOLENOID VALVE FOR GLASS CLEANING |
| pCO2-ALARM 2 | -QIC_001 | /19.2:E | 5 | I22.3 | Q112.7 | 25 | /21.5:E | -K6:A1 3. SOLENOID VALVE FOR GLASS CLEANING |
| pH-ALARM 1 | -QIC_002TI_001 | /19.3:E | 6 | I22.4 | Q113.0 | 26 | /21.6:E | -K7:A1 4. SOLENOID VALVE FOR GLASS CLEANING |
| pH-ALARM 2 | -QIC_002TI_001 | /19.4:E | 7 | I22.5 | Q113.1 | 27 | /21.7:E | -K8:A1 RESERVE |
| TEMPERATURE-ALARM 1 | -QIC_002TI_001 | /19.4:E | 8 | I22.6 | Q113.2 | 28 | /22.2:E | -K1:A1 ELECTRIC MOTOR FOR MAIN VALVE |
| O2-ALARM 1 | -QI_003 | /19.5:E | 9 | I22.7 | Q113.3 | 29 | /22.3:E | -K2:A1 ELECTRIC MOTOR FOR BYPASS VALVE |
| | | | 10 | | | 30 | 2M | /13.4:E |
| | | | 11 | | | 31 | 3L+ | /13.4:D |
| O2-ALARM 2 | -QI_003 | /19.5:E | 12 | I23.0 | Q113.4 | 32 | /22.4:E | -K9:A1 PUMP ON |
| TURBIDITY-ALARM 1 | -QI_004 | /19.6:E | 13 | I23.1 | Q113.5 | 33 | /22.6:E | RESERVE |
| TURBIDITY-ALARM 2 | -QI_004 | /19.7:E | 14 | I23.2 | Q113.6 | 34 | /22.6:E | RESERVE |
| RESERVE | -X5:17 | /20.2:E | 15 | I23.3 | Q113.7 | 35 | /22.6:E | RESERVE |
| RESERVE | -X5:19 | /20.3:E | 16 | I23.4 | Q114.0 | 36 | /22.7:E | RESERVE |
| RESERVE | -X5:21 | /20.4:E | 17 | I23.5 | Q114.1 | 37 | /22.7:E | RESERVE |
| PULSE OUTPUT 1 FROM WATER FLOWMETER | -FIRC_003 | /20.5:E | 18 | I23.6 | Q114.2 | 38 | /22.7:E | RESERVE |
| PULSE OUTPUT 2 FROM WATER FLOWMETER | -FIRC_003 | /20.6:E | 19 | I23.7 | Q114.3 | 39 | /22.7:E | RESERVE |
| | | /13.4:E | 20 | 1M | 3M | 40 | 3M | /13.4:E |

6ES7 323-1BL00-0AA0

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - CONNECTION OF MODULE DI/DO |
| | | | | Drawn | Ing. Harašta | | |
| | | | | Checked | Ing. Kincl | | |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | |

BCS Engineering, a.s. BRNO

1798 DA5 001 | = | +CJK01

1798 | Sheet 8 | Next 9

-A30
/6.4:B
RackX
SlotY

SM 331
AI 8 x 13 BIT

SIEMENS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | PIW348 | PIW388 | 21 | | | |
| pCO2 | -QIC_001-QIC_001:1 | /15.2:E | 2 | PIW350 | PIW390 | 22 | /15.7:E | -QI_004-QI004:1 | TURBIDITY OF SUSPENSION |
| | | | 3 | PIW352 | PIW392 | 23 | | | |
| | | | 4 | PIW354 | PIW394 | 24 | | | |
| | | | 5 | PIW356 | PIW396 | 25 | | | |
| | | | 6 | PIW358 | PIW398 | 26 | | | |
| pH | QIC_002TI_001-QIC_002:1 | /15.3:E | 7 | PIW360 | PIW400 | 27 | /16.4:E | -FIRC_001FV_001-DB9:1 | FLOW CO2 |
| | | | 8 | PIW362 | PIW402 | 28 | | | |
| | | | 9 | PIW364 | PIW404 | 29 | | | |
| | | | 10 | PIW366 | PIW406 | 30 | | | |
| | | | 11 | PIW368 | PIW408 | 31 | | | |
| TEMPERATURE OF SUSPENSION | QIC_002TI_001-QIC_002:1 | /15.4:E | 12 | PIW370 | PIW410 | 32 | /16.5:E | -FIC_002-QI_003:31 | FLOW OF SUSPENSION |
| | | | 13 | PIW372 | PIW412 | 33 | | | |
| | | | 14 | PIW374 | PIW414 | 34 | | | |
| | | | 15 | PIW376 | PIW416 | 35 | | | |
| | | | 16 | PIW378 | PIW418 | 36 | | | |
| O2 | -QI_003-QI_003:1 | /15.6:E | 17 | PIW380 | PIW420 | 37 | /16.8:E | -LISA_002-M12:4 | LEVEL OF SUSPENSION ON PLATFORM |
| | | | 18 | PIW382 | PIW422 | 38 | | | |
| | | | 19 | PIW384 | PIW424 | 39 | | | |
| | | | 20 | PIW386 | PIW426 | 40 | | | |

6ES7 331-1KF01-0AB0

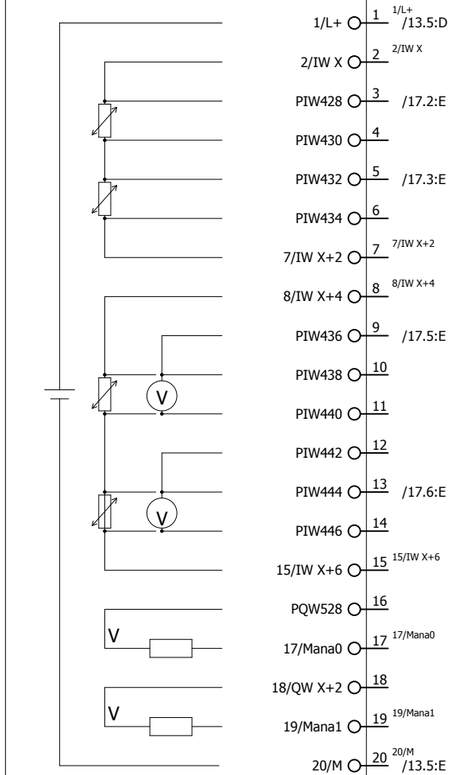
| Rev.No. | Description | Date | Name | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS® Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - CONNECTION OF MODULE AI |
| | | | | Drawn | Ing. Harašta | | | |
| | | | | Checked | Ing. Kincl | | | |
| | | | | Approval | Ing. Kostelník | | | |

| | |
|---|---|
| 1798 DA5 001 | = |
| | +CJK01 |
| 1798 | Sheet 9 |
| | Next 10 |

-A40
/6.5:B
RackX
SlotY

SIEMENS

SM 334
AI 4/AO 2 x 12 BIT




| | | | | |
|---|---|---|---|---|
| 1/L+ | 1 | 1/L+ /13.5:D | | |
| 2/IW X | 2 | 2/IW X | | |
| PIW428 | 3 | /17.2:E | -LISA_001-ISO4400:3 | LEVEL OF SUSPENSION IN TANK |
| PIW430 | 4 | | | |
| PIW432 | 5 | /17.3:E | -PIC_001-ISO4400:3 | OUTPUT PRESSURE OF PUMP |
| PIW434 | 6 | | | |
| 7/IW X+2 | 7 | 7/IW X+2 | | |
| 8/IW X+4 | 8 | 8/IW X+4 | | |
| PIW436 | 9 | /17.5:E | -MCA_001:B1 | ACTUAL SPEED OF PUMP |
| PIW438 | 10 | | | |
| PIW440 | 11 | | | |
| PIW442 | 12 | | | |
| PIW444 | 13 | /17.6:E | | RESERVE |
| PIW446 | 14 | | | |
| 15/IW X+6 | 15 | 15/IW X+6 | | |
| PQW528 | 16 | | | SETPOINT FLOW CO2 |
| 17/Mana0 | 17 | 17/Mana0 | | |
| 18/QW X+2 | 18 | | | SETPOINT SPEED OF PUMP |
| 19/Mana1 | 19 | 19/Mana1 | | |
| 20/M | 20 | 20/M /13.5:E | | |

6ES7 334-0KE00-0AB0

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, BRNO a.s. | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - CONNECTION OF MODULE AI/AO | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 10 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 11 |

# CONTROL CUBICLE

# CJK01

# POWER SUPPLY WIRING DIAGRAMS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | 1798 DA5 001 | = |
| | | | | Drawn | Ing. Harašta | | CONTROL CUBICLE - POWER SUPPLY WIRING DIAGRAMS | | +CJK01 |
| | | | | Checked | Ing. Kincl | | | 1798 | Sheet 11 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 12 |

+CJK01

L
N
PE

-FA1
10A C

-FA8
10A B

-FA2
2A B

-FA3
10A B

-Q1
25 A

-OF
PROTECTION

-PS
230V AC
24V DC
1L+
1L-
+24V DC
0V DC
24V_L+
13.1:A
GND
13.1:F

-H1
SOCKET CH
+LIGHT

-H2
SOCKET DIN
("SCHUKO")

QIC_001
/15.1:C
/19.1:A

QIC_002
TI_001
/15.3:C
/19.3:A

QI_003
/15.5:C
/19.5:A

QI_004
/15.7:C
/19.6:A

MCA_001
/17.5:C
/22.4:C

-X1
-X2
-X3

PLANT

-W1
CYKY-J 3x2,5
20 m
3x2,5
450/750V

+ROZVADĚČ ZÁKAZNÍKA

-W2
CYKY-J 3x1,5
3 m
3x1,5
450/750V

FIC_002
/16.5:A

-W3
CYKY-J 4x2,5
3 m
4x2,5
450/750V

M
3 ~

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - SUPPLY VOLTAGE 230V/50HZ | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 12 Next 13 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | |

+CJK01

12.3:D / 24V_L+ ← -PS:1L+

-FA4 6A B (1, 2)

-FA5 4A B (1, 2)

-FA6 2A B (1, 2)

-FA7 6A B (1, 2)

L1 / 19.7:D

L2 / 16.8:D

L3 / 21.2:D

-OP /24.5:B 10-36 V (+24V DC, GND)

-A10 /6.2:B — M, L+ — 24VDC / 5VDC — 6ES7 317-2EK14-0AB0 — R1-A10

-A20 /6.3:B — 21 (2L+ /8.6:B), 31 (3L+ /8.6:C) — 6ES7 323-1BL00-0AA0 — R1-A20 — DI/DO 16 x DC 24V/0,5A — /8.3:E 1M, /8.6:C 2M, /8.6:E 3M — 20, 30, 40

-A30 /6.4:B — 6ES7 331-1KF02-0AB0 — R1-A30 — AI 8 x 13 BIT

-A40 /6.5:B — 1 (1/L+ /10.4:B) — 6ES7 334-0KE00-0AB0 — R1-A40 — AI 4/AO 2 x 12 BIT — /10.4:E 20/M — 20

12.3:D / GND ← -PS:1L-

-R1-A30:40 → GND / 16.8:D

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - SUPPLY VOLTAGE 24V DC | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 13 Next 14 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | |

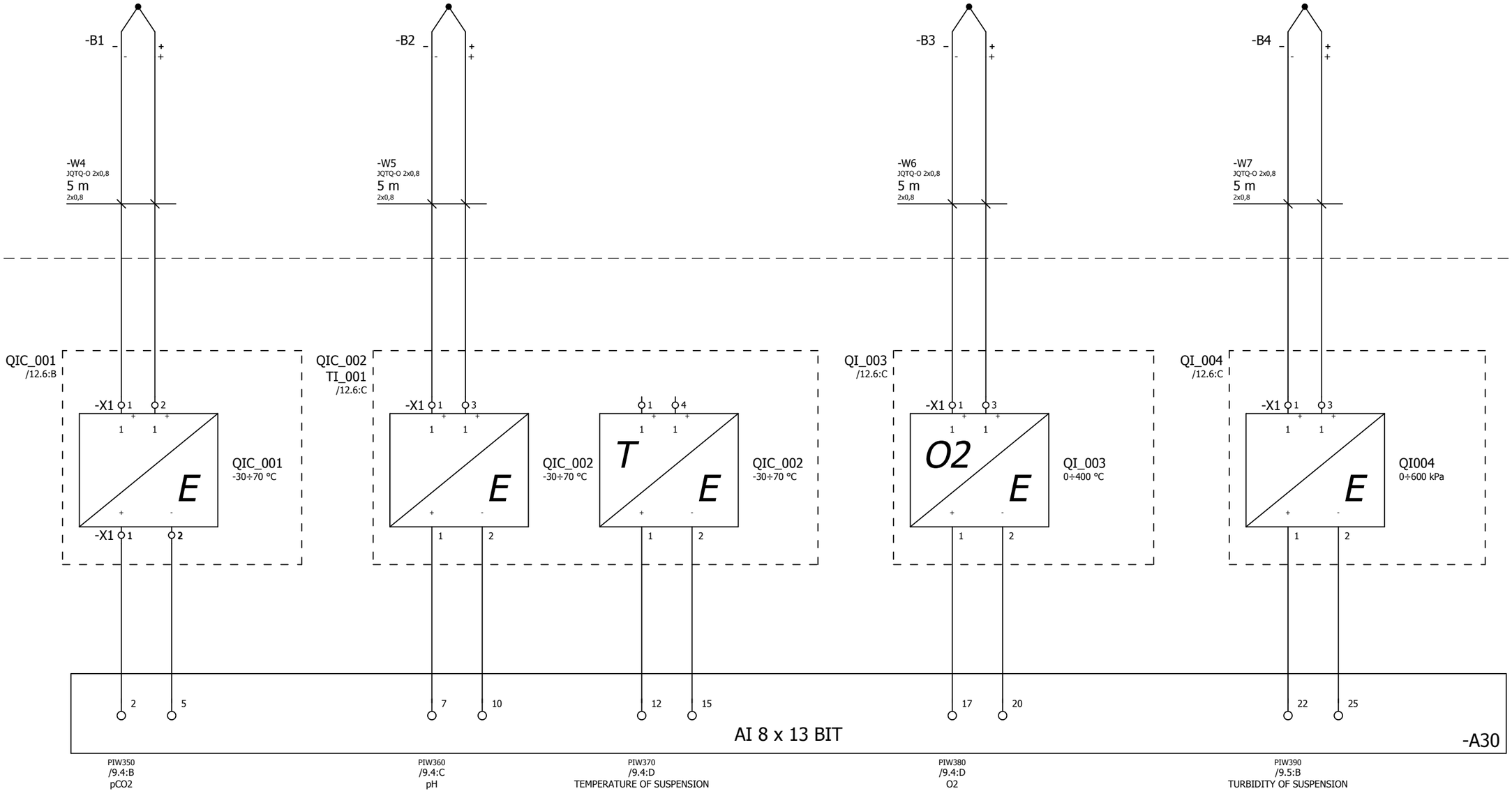
# CONTROL CUBICLE

# CJK01

# WIRING DIAGRAMS OF AI/AO

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - WIRING DIAGRAMS OF ANALOG I/O | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 14 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 15 |

PLANT

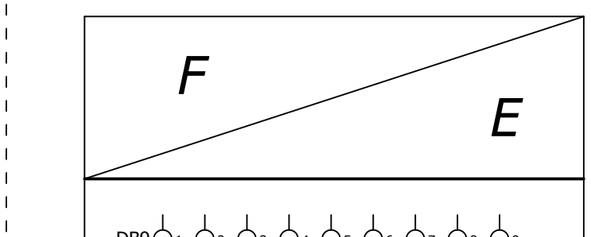



+CJK01

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - AI-pCO2, pH, TEMPERATURE, O2, TURBIDITY | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 15 Next 16 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | |

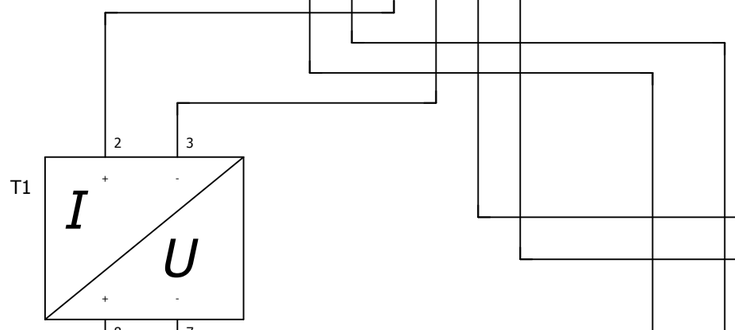
PLANT

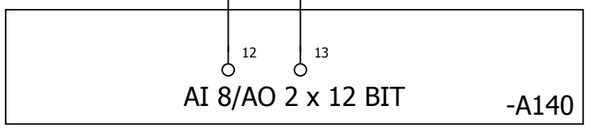
FIRC_001
FV_001




-W8
JQTQ-O 2x0,8
3 m
2x0,8

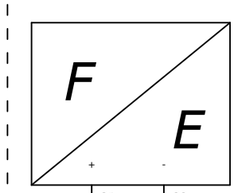
-X4 1 2 3 4 5 6 7 8 9




PQW528
SETPOINT FLOW CO2

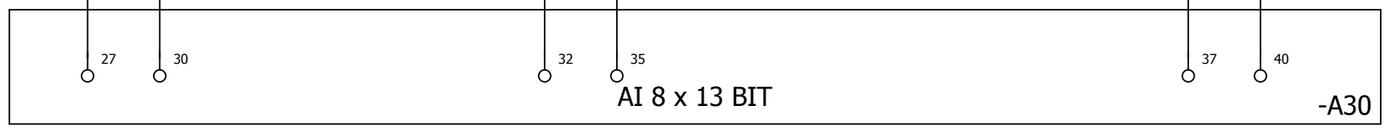
FIC_002
/12.6:E




-QI_003
0÷400 °C

-W9
JQTQ-O 2x0,8
3 m
2x0,8

-X4 10 11

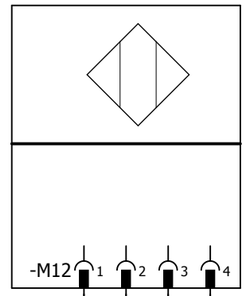



PIW400
/9.5:C
FLOW CO2

PIW410
/9.5:D
FLOW OF SUSPENSION

PIW420
/9.5:D
LEVEL OF SUSPENSION ON PLATFORM

LISA_002




-W10
JQTQ-O 2x0,8
10 m
2x0,8

-X4 12 13 14 15

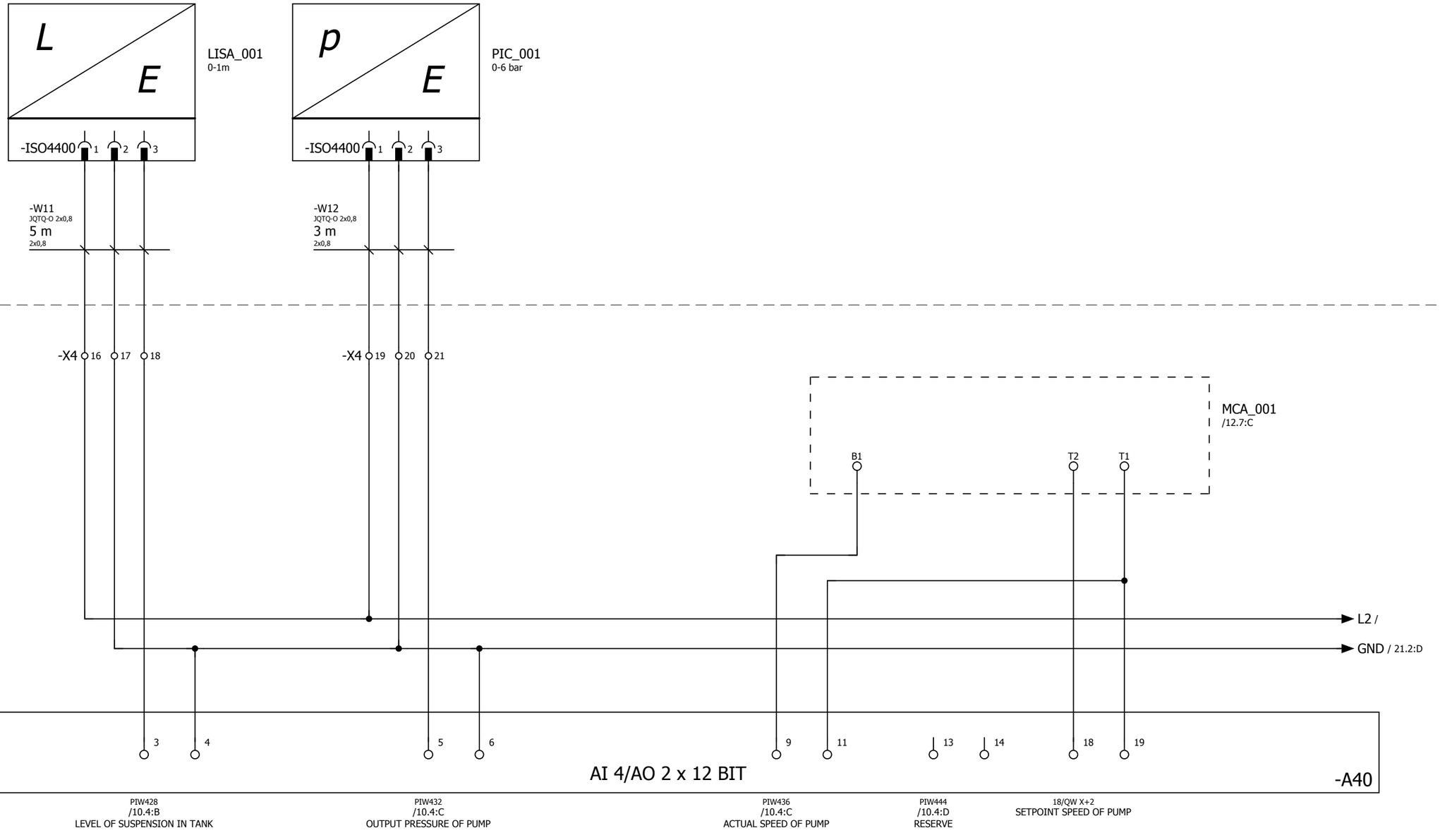
L2 / 13.8:B

GND / 13.8:F

+CJK01

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - FLOW CO2 AND SUSPENSION, LEVEL OF SUSPENSION ON PLATFORM | 1798 DA5 001 | = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 | Sheet 16 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | | Next 17 |

PLANT




+CJK01

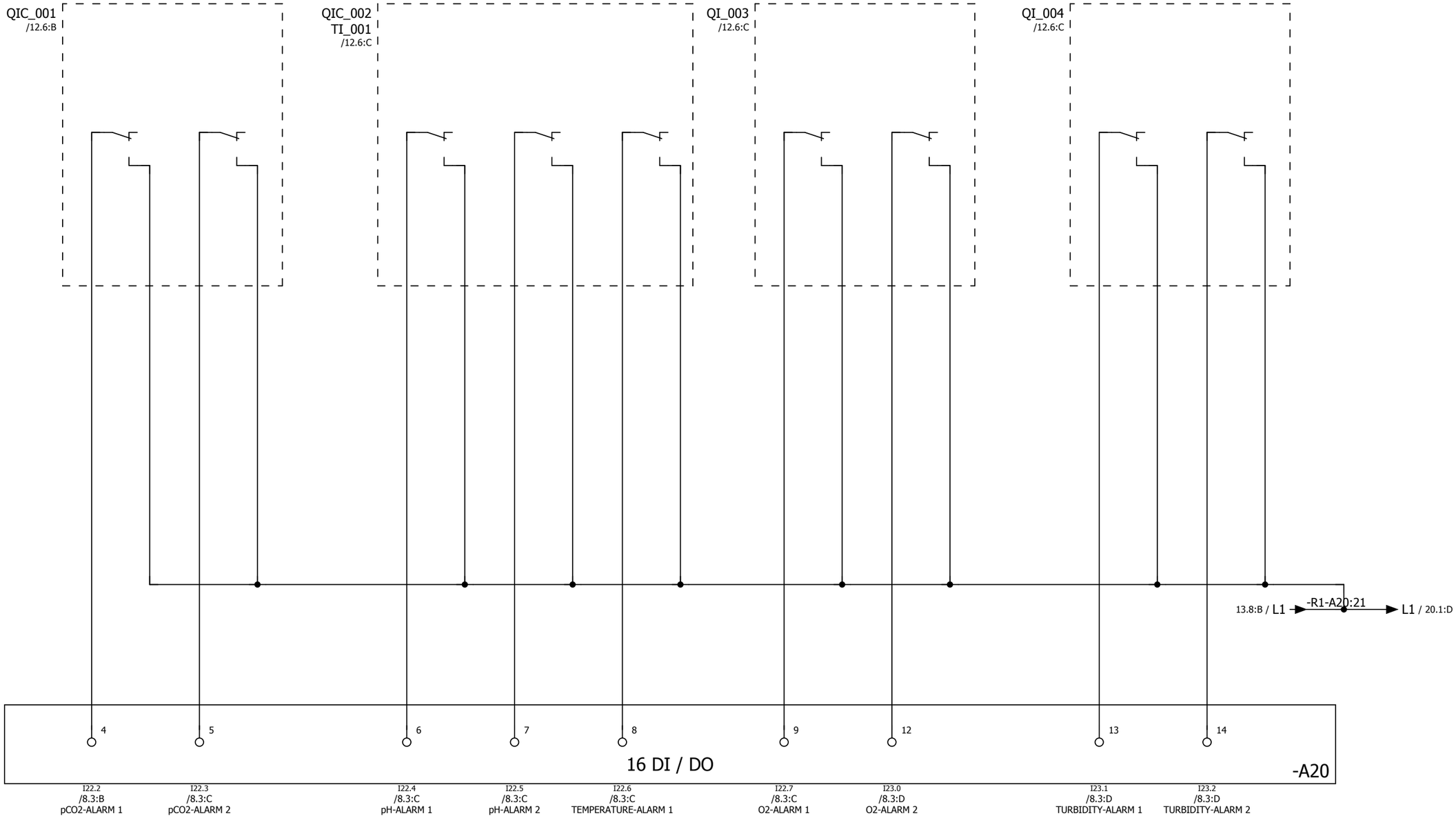
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - LEVEL IN TANK, PRESSURE, PUMP | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 17 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 18 |

# CONTROL CUBICLE

# CJK01

# WIRING DIAGRAMS OF DI/DO

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - WIRING DIAGRAMS OF DI/DO | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 18 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 19 |




+CJK01

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - DI-pCO2, pH, TEMPERATURE, O2, TURBIDITY | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 19 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 20 |

FIRC_003

-W13
JQTQ-O 2x0,8
1,5 m
4x0,8

-X5 17 18 19 20 21 22 23 24 25 26

19.8:D / L1

15 16 17 18 19

16 DI / DO

-A20

I23.3
/8.3:D
=+CJK01-X5:17
RESERVE

I23.4
/8.3:D
RESERVE

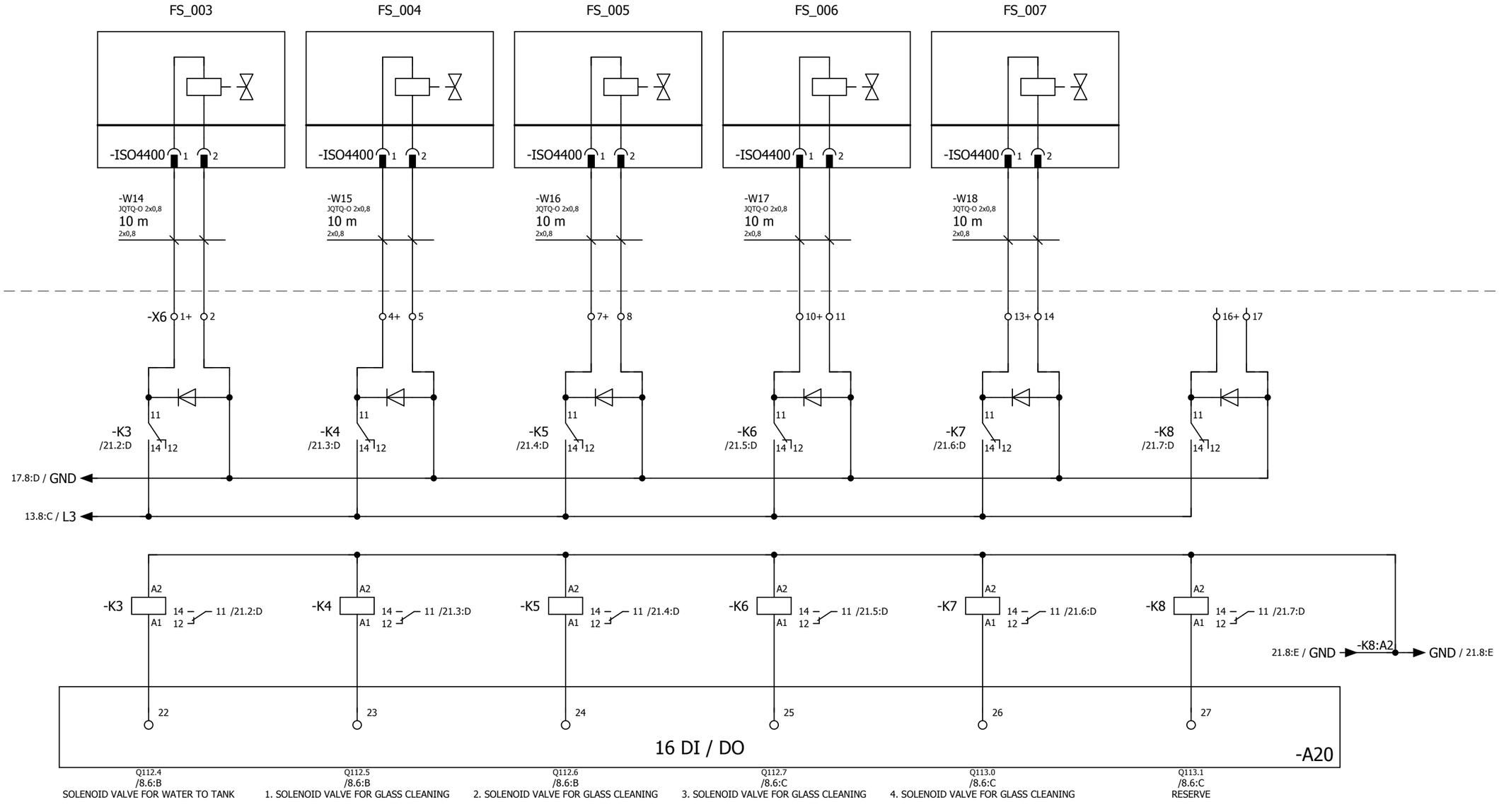
I23.5
/8.3:D
RESERVE

I23.6
/8.3:D
PULSE OUTPUT 1
FROM WATER FLOWMETER

I23.7
/8.3:E
PULSE OUTPUT 2
FROM WATER FLOWMETER

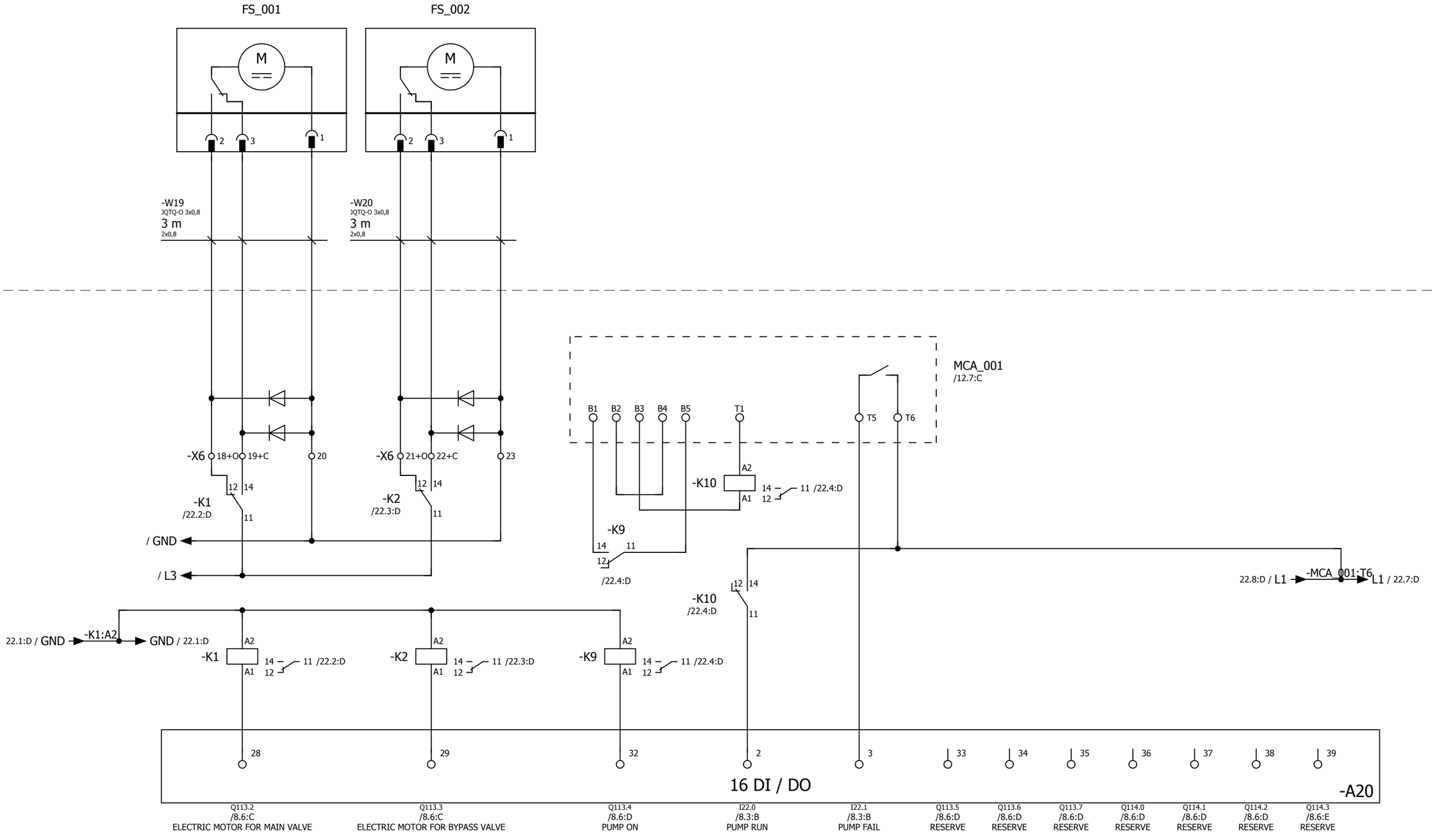
+CJK01

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - DI-FLOW WATER AND RESERVES | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 20 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 21 |




+CJK01

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS® Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - SOLENOID VALVES AND RESERVE | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | 1798 Sheet 21 |
| | | | | Checked | Ing. Kincl | | | | Next 22 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | |




+CJK01

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - VALVES WITH MOTOR, AC DRIVER AND RESERVES |
| | | | | Drawn | Ing. Harašta | | | |
| | | | | Checked | Ing. Kincl | | | |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | |

| | | | |
|---|---|---|---|
| 1798 DA5 001 | | = | |
| | | +CJK01 | |
| | 1798 | Sheet | 22 |
| | | Next | 23 |

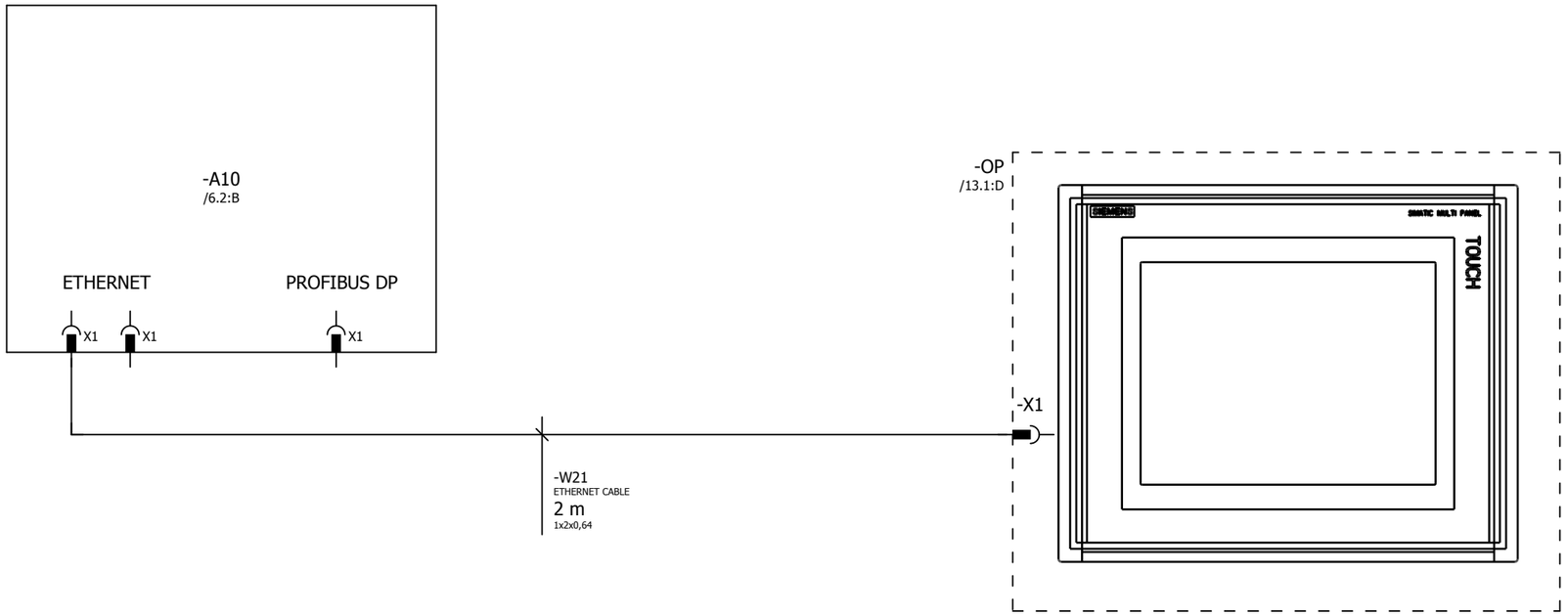
# CONTROL CUBICLE

# CJK01

# WIRING DIAGRAMS COMMUNICATION

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | 1798 DA5 001 | = |
| | | | | Drawn | Ing. Harašta | | | | +CJK01 |
| | | | | Checked | Ing. Kincl | | CONTROL CUBICLE - COMMUNICATION | 1798 | Sheet 23 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next 24 |

+CJK01




| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | CONTROL CUBICLE - PROFIBUS DP AND ETHERNET | 1798 DA5 001 = +CJK01 |
| | | | | Drawn | Ing. Harašta | | | | |
| | | | | Checked | Ing. Kincl | | | | 1798 Sheet 24 |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | | Next +/1 |

# Table of contents

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F06_001



| Rev.No. | Description | Date | Name | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW |
| | | | | Drawn | Ing. Harašta | | |
| | | | | Checked | Ing. Kincl | | CONTENT : =+CJK01/1 - =+/3 |
| | | | | Approval | Ing. Kostelník | | 1798 |

1798 DA5 001 | =

Sheet 1

Next 2

# Cable overview

F10_001

| Cable name | Source (from) | Target (to) | cable type | all conductors | Conductors used | Cross-section [mm] | Length [m] | function text | Graphical page of cable diagram |
|---|---|---|---|---|---|---|---|---|---|
| +CJK01-W1 | | | CYKY-J 3x2,5 | 3 | 0 | 2,5 | 20 | | |
| +CJK01-W2 | +CJK01-FIC_002-X1 | +CJK01-X2 | CYKY-J 3x1,5 | 3 | 3 | 1,5 | 3 | 230VAC 50Hz | |
| +CJK01-W3 | +CJK01-X3 | +CJK01-M | CYKY-J 4x2,5 | 4 | 5 | 2,5 | 3 | = | |
| +CJK01-W4 | +CJK01-QIC_001-X1 | +CJK01-B1 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 5 | | |
| +CJK01-W5 | +CJK01-QIC_002TI_001-X1 | +CJK01-B2 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 5 | | |
| +CJK01-W6 | +CJK01-QI_003-X1 | +CJK01-B3 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 5 | | |
| +CJK01-W7 | +CJK01-QI_004-X1 | +CJK01-B4 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 5 | | |
| +CJK01-W8 | +CJK01-FIRC_001FV_001-DB9 | +CJK01-X4 | JQTQ-O 2x0,8 | 2 | 9 | 0,8 | 3 | | |
| +CJK01-W9 | +CJK01-X4 | +CJK01-FIC_002-QI_003 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 3 | | |
| +CJK01-W10 | +CJK01-LISA_002-M12 | +CJK01-X4 | JQTQ-O 2x0,8 | 2 | 4 | 0,8 | 10 | | |
| +CJK01-W11 | +CJK01-LISA_001-ISO4400 | +CJK01-X4 | JQTQ-O 2x0,8 | 2 | 3 | 0,8 | 5 | | |
| +CJK01-W12 | +CJK01-PIC_001-ISO4400 | +CJK01-X4 | JQTQ-O 2x0,8 | 2 | 3 | 0,8 | 3 | | |
| +CJK01-W13 | +CJK01-X5 | +CJK01-FIRC_003 | JQTQ-O 2x0,8 | 4 | 4 | 0,8 | 1,5 | | |
| +CJK01-W14 | +CJK01-FS_003-ISO4400 | +CJK01-X6 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 10 | | |
| +CJK01-W15 | +CJK01-FS_004-ISO4400 | +CJK01-X6 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 10 | | |
| +CJK01-W16 | +CJK01-FS_005-ISO4400 | +CJK01-X6 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 10 | | |
| +CJK01-W17 | +CJK01-FS_006-ISO4400 | +CJK01-X6 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 10 | | |
| +CJK01-W18 | +CJK01-FS_007-ISO4400 | +CJK01-X6 | JQTQ-O 2x0,8 | 2 | 2 | 0,8 | 10 | | |
| +CJK01-W19 | +CJK01-FS_001 | +CJK01-X6 | JQTQ-O 3x0,8 | 2 | 3 | 0,8 | 3 | | |
| +CJK01-W20 | +CJK01-FS_002 | +CJK01-X6 | JQTQ-O 3x0,8 | 2 | 3 | 0,8 | 3 | | |
| +CJK01-W21 | +CJK01-OP-X1 | +CJK01-R1-A10 | ETHERNET CABLE | 1x2 | 1 | 0,64 | 2 | | |

| Rev.No. | Description | Date | Name | | |
|---|---|---|---|---|---|
| | | | | Date | 20.12.2012 |
| | | | | Drawn | Ing. Harašta |
| | | | | Checked | Ing. Kincl |
| | | | | Approval | Ing. Kostelník |

BCS® Engineering, a.s. BRNO

Customer:
Zürich University of Applied Sciences
ZHAW

CABLE LIST : =+CJK01-W1 - =+CJK01-W21

1798 DA5 001

=

1798

Sheet 2

Next 3

# Parts list

F01_001

| device tag | Quantity | designation | Type number | supplier | part number |
|---|---|---|---|---|---|
| +CJK01-R1 | 1 | SIMATIC S7-300, Rail; L=480mm | 6ES7390-1AE80-0AA0 | SIEMENS | SIE.6ES7390-1AE80-0AA0 |
| +CJK01-R1-A10 | 1 | SIMATIC S7-300, CPU 317-2 PN/DP | 6ES7317-2EK14-0AB0 | SIEMENS | SIE.6ES7317-2EK14-0AB0 |
| +CJK01-R1-A20 | 1 | SIMATIC S7-300, digital input / output module SM 323 | 6ES7323-1BL00-0AA0 | SIEMENS | SIE.6ES7323-1BL00-0AA0 |
| +CJK01-R1-A30 | 1 | SIMATIC S7-300, analog input SM 331 | 6ES7331-1KF02-0AB0 | SIEMENS | SIE.6ES7331-1KF02-0AB0 |
| +CJK01-R1-A40 | 1 | SIMATIC S7-300, analog output module SM 334 | S7 | SIEMENS | SIE.6ES7334-0KE00-0AB0 |
| +CJK01-Q1 | 1 | Main switch | VSN25 1103A8-V-NVZ3R | ELKOV | OBZOR.VSN25_1103A8-V-NVZ3R |
| +CJK01-PS | 1 | SITOP PSU100L 24V/10 A, INPUT 230V AC | 6EP1334-1LB00 | SIEMENS | SIE.6EP1334-1LB00 |
| +CJK01-OF | 1 | SURGE PROTECTION | PT 2-PE/S-230AC-ST | Phoenix Contact | PHO.PT 2-PE/S-230AC-ST |
| +CJK01-OF | 1 | CONNECTOR FOR SURGE PROTECTION | PT-BE/FM | Phoenix Contact | PHO.PT-BE/FM |
| +CJK01-FA1 | 1 | Breaker 10A / C | OEZ.LPE-10C-1 | REXEL | OEZ.LPE-10C-1 |
| +CJK01-FA8 | 1 | RESIDUAL CURRENT CIRCUIT BREAKERS WITH OVERCURRENT PROTECTION | OLE-10B-1N-030AC | REXEL | OEZ.OLE-10B-1N-030AC |
| +CJK01-H1 | 1 | Compact Lamp with electrical swiss socket | KL 025 | GHV | STEGO.KL 025 |
| +CJK01-H2 | 1 | Socket outlet DIN ("SCHUKO"), Connection-bottom | ZSF-03 | OEZ | OEZ.ZSF-03 |
| +CJK01-QIC_001 | 1 | Transmitter M400 Type 3 | M400 Type 3 | METTLER TOLEDO | MT.M400_Type 3 |
| +CJK01-QIC_002TI_001 | 1 | Transmitter M300 | M300 | METTLER TOLEDO | MT.M300 |
| +CJK01-QI_003 | 1 | Transmitter M400 Type 2 | M400 Type 2 | METTLER TOLEDO | MT.M400_Type 2 |
| +CJK01-QI_004 | 1 | Transmitter SC200 | SC200 | HACH LANGE | HACH_LANGE.SC200 |
| +CJK01-FIC_002 | 1 | Electromagnetic flowmeter MAG 1100 | MAG 1100 | SIEMENS | SIEMENS.MAG 1100 |
| +CJK01-FA2 | 1 | Breaker 2A / B | OEZ.LPE-2B-1 | REXEL | OEZ.LPE-2B-1 |
| +CJK01-MCA_001 | 1 | General purpose AC drive | Commander SK | CT | CT.Commander SK |
| +CJK01-M | 1 | ELECTRIC MOTOR FOR PUMP | NB40 | GRUNDFOS | GRUNDFOS.NB40 |
| +CJK01-FA3 | 1 | Breaker 10A / B | OEZ.LPE-10B-1 | REXEL | OEZ.LPE-10B-1 |
| +CJK01-OP | 1 | OPERATOR PANEL TP1200 | TP1200 | SIEMENS | SIE.TP1200 |
| +CJK01-FA4 | 1 | Breaker 6A / B | OEZ.LPE-6B-1 | REXEL | OEZ.LPE-6B-1 |
| +CJK01-FA5 | 1 | Breaker 4A / B | OEZ.LPE-4B-1 | REXEL | OEZ.LPE-4B-1 |
| +CJK01-FA6 | 1 | Breaker 2A / B | OEZ.LPE-2B-1 | REXEL | OEZ.LPE-2B-1 |
| +CJK01-FA7 | 1 | Breaker 6A / B | OEZ.LPE-6B-1 | REXEL | OEZ.LPE-6B-1 |
| +CJK01-B1 | 1 | SENSOR pCO2 | InPro5000i/12/120 | METTLER TOLEDO | MT.InPro5000i/12/120 |
| +CJK01-B2 | 1 | SENSOR pH | InPro3253i/SG/120 | METTLER TOLEDO | MT.InPro3253i/SG/120 |
| +CJK01-B3 | 1 | SENSOR O2 | InPro6860i/12/120 | METTLER TOLEDO | MT.InPro6860i/12/120 |
| +CJK01-B4 | 1 | TURBIDITY SENSOR | SOLITAX inline sc | HACH LANGE | HACH_LANGE.SOLITAX inline sc |
| +CJK01-T1 | 1 | TRANSMITTER | KFD0-CC-1 | PEPPERL FUCHS | PEP.KFD0-CC-1 |
| +CJK01-FIRC_001FV_001 | 1 | DIGITAL MASS FLOW CONTROLLER | C50 | KROHNE | SIERRA_C50 |
| +CJK01-LISA_002 | 1 | ULTRASONIC SENSOR | UB120-12GM-I-V1 | PEPPERL FUCHS | PEP.UB120-12GM-I-V1 |
| +CJK01-LISA_001 | 1 | LEVEL SENSOR | LMK 351 | JSP | BD.LMK 351 |
| +CJK01-PIC_001 | 1 | PRESSURE SENSOR | DMK 331 | JSP | BD.DMK 331 |
| +CJK01-FS_003 | 1 | SOLENOID VALVE | 2VE25DA | BELIMO | BELIMO_2VE25DA |
| +CJK01-K3 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-FS_004 | 1 | SOLENOID VALVE | 2VE25DA | BELIMO | BELIMO_2VE25DA |
| +CJK01-K4 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-FS_005 | 1 | SOLENOID VALVE | 2VE25DA | BELIMO | BELIMO_2VE25DA |
| +CJK01-K5 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-FS_006 | 1 | SOLENOID VALVE | 2VE25DA | BELIMO | BELIMO_2VE25DA |
| +CJK01-K6 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-FS_007 | 1 | SOLENOID VALVE | 2VE25DA | BELIMO | BELIMO_2VE25DA |
| +CJK01-K7 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-K8 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-FS_001 | 1 | ELECTRIC MOTOR FOR VALVE | SM24A | BELIMO | BELIMO.SM24A |
| +CJK01-K1 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-FS_002 | 1 | ELECTRIC MOTOR FOR VALVE | SM24A | BELIMO | BELIMO.SM24A |
| +CJK01-K2 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-K9 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
| +CJK01-K10 | 1 | Relay Microseries 24VDC 1CO | Relé:MRZ 24VDC 1CO(8533660000) | WEI | WEI.MRZ 24VDC 1CO |
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| | | | | Date | 20.12.2012 | BCS Engineering, a.s. BRNO | Customer: Zürich University of Applied Sciences ZHAW | SPECIFICATIONS : SIE.6ES7390-1AE80-0AA0 - WEI.MRZ 24VDC 1CO |
| | | | | Drawn | Ing. Harašta | | | |
| | | | | Checked | Ing. Kincl | | | |
| Rev.No. | Description | Date | Name | Approval | Ing. Kostelník | | | |

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