

PD3-F

smar

OCT / 13
PD3-F
VERSION 3



INSTRUCTIONS, OPERATION AND
MAINTENANCE MANUAL

DIDACTIC PILOT PLANT



smar
www.smar.com

Specifications and information are subject to change without notice.
Up-to-date address information is available on our website.

web: www.smar.com/contactus.asp

This instructions manual describes the functionalities and all the information on specifications, installation, operation and maintenance for the Smar Didactical Plant.

NOTE

Only qualified personnel should install, operate and carry out the maintenance of this equipment.

For any doubts concerning the instructions or information not included in this manual, please contact Smar for clarifications or details.

WHAT THIS MANUAL CONTAINS

This manual contains all sections listed below. Each section has its own index. Consult the index to each section for a complete list of subsections.

INTRODUCTION

Informs the manual contents and describes briefly the **PD3-F - FOUNDATION™ fieldbus**.

SECTION 1 – INSTALLATION

Informs which are the minimum requirements for the PD3 mechanical, electrical, pneumatic and hydraulic installation.

SECTION 2 – OPERATION

Clarifies details on the PD3 operation and work (P&I Diagram).

SECTION 3 – CONFIGURATION

Detailed instructions on the PD3 configuration, control and supervision.

SECTION 4 – MAINTENANCE

Presents, among others, information on the PD3 maintenance procedures and equipment.

SECTION 5 – TECHNICAL CHARACTERISTICS

Describes the PD3 specifications and other related information.

APPENDIX A

Lists applications details: Anticipatory Control and Negative Repowering, Cascade Control.

APPENDIX B

Lists details on Smar guarantee and the return of materials.

NOTE

Get better results from the PD3 by carefully reading the instructions in this manual.
--

INTRODUCTION

The Smar Didactical Plant represents in a simple and objective way the operation of multiple control loops to be implemented on a plant for training and technological update on control loops for the industrial process automation. It uses the same field devices and software applications for configuration and operation developed for large scale applications.

The Smar Didactical Plant compact format makes all the components for automation control available to be handled and monitored by instructors and students.

The Didactical Plant reproduces control and supervision processes in a compact system that respects the reality of Industrial Automation at the same time.

The control loops on the Smar Didactical Plant simulate the same field features met by experienced instrumentation professionals, in a way that both the apprentice and the instructor may access the highest possible technology available in the market in their own teaching laboratory.

The flexible device configuration allows creating other control loops in addition to the Smar previously supplied ones, without having to physically restructure the equipment, hence enabling better use and integration of the Didactical Plant to any teaching methodology.

- Available in the most modern technologies: HART®, FOUNDATION™ fieldbus e PROFIBUS PA;
- Easy installation, maintenance and operation;
- The most flexible, modern and resistant on the market;
- Differentiated mechanical characteristics;
- Compact format, light Aluminum structure;
- Easy to transport, without dismounting;
- Flexibility for device configuration;
- Reproduces the industrial reality with the highest available technology;
- Complete, with the principal measuring variables of a real plant;
- Control loops, previously supplied by Smar;
- Allows the creation of other control loop strategies;
- Recommended for Control and Automation apprentices and professionals;
- Equipped with base wheels for easier displacement;
- Stainless steel tanks and pipes;
- Frontal startup and command panel;
- Accepts one or more remote supervision stations.
- Smar recognizes the importance of being the closest possible to a real plant to train technicians, engineers and instrumentation technicians in Brazil and all over Latin America.

Smar offers an area dedicated to help schools and companies, in addition to optional didactical kits, instruments, support and specific training for the Didactical Plant.

ATTENTION

This manual is related to the FOUNDATION™ fieldbus protocol and the family of Smar field devices and applications made for this technology.

Consult the specific manual for each SMAR product to obtain more details about the FD3-F control and operation.

NOTE

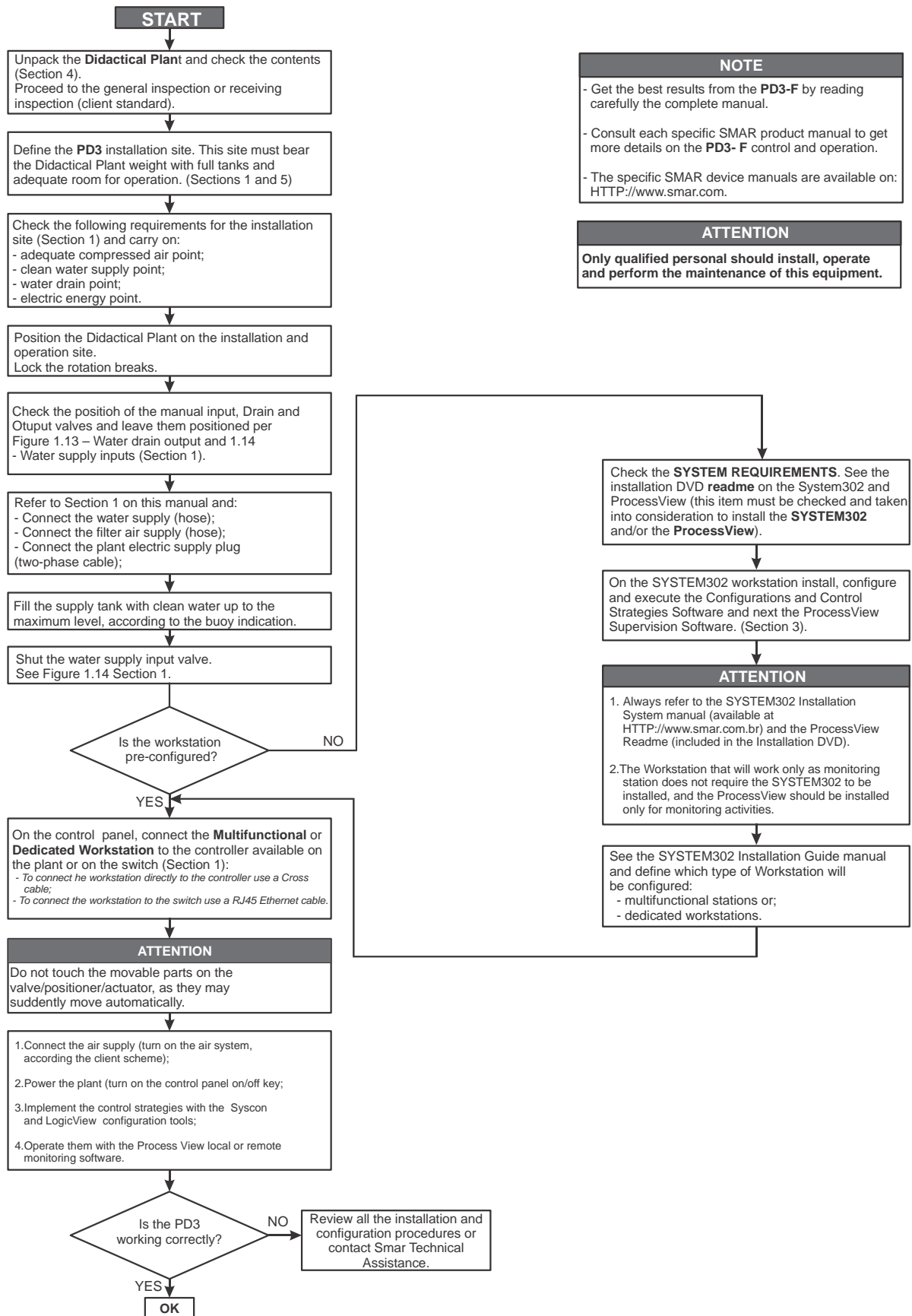
This manual is compatible with the 3.XX versions, where 3 indicates the software version and XX indicates the review. Therefore, the manual is compatible with all of version 3 reviews.

TABLE OF CONTENTS

SECTION 1 - INSTALLATION	1.1
WAIVER OF RESPONSIBILITY.....	1.1
WARNING.....	1.1
GENERAL.....	1.2
REQUIREMENTS FOR INSTALLING AND OPERATING THE DIDACTICAL PLANT.....	1.2
MOUNTING.....	1.2
WORK STATION AND PERIPHERALS.....	1.2
PD3 DIMENSIONS.....	1.3
MECHANICAL FLOWSHEET.....	1.4
PNEUMATIC CONNECTIONS.....	1.5
AIR SUPPLY.....	1.5
RECOMMENDATIONS FOR AN INSTRUMENT AIR SUPPLY SYSTEM.....	1.6
PNEUMATIC CONNECTIONS PROCEDURES.....	1.7
ELECTRICAL CONNECTIONS.....	1.8
ELECTRICAL CONNECTIONS PROCEDURES.....	1.8
POWER DIAGRAMS.....	1.10
WATER SUPPLY.....	1.11
WATER CONNECTIONS PROCEDURES.....	1.13
NETWORK CONFIGURATION AND TOPOLOGY.....	1.14
SECTION 2 - OPERATION	2.1
DIDACTICAL PLANT GENERAL FEATURES.....	2.1
DIDACTICAL PLANT COMPOSITION.....	2.1
PD3 FUNCTIONAL DESCRIPTION.....	2.7
CONTROL LOOPS.....	2.7
CIRCUIT FUNCTIONAL DESCRIPTION.....	2.10
SECTION 3 - CONFIGURATION	3.1
WORKSTATION.....	3.1
SYSTEM REQUIREMENTS.....	3.1
SOFTWARE.....	3.2
CONFIGURATIONS AND CONTROL STRATEGIES SOFTWARE.....	3.2
SUPERVISION SOFTWARE.....	3.2
SECTION 4 - MAINTENANCE	4.1
DISMOUNTING PROCEDURE.....	4.1
CLEANING PROCEDURE.....	4.1
HYDRAULIC SYSTEM.....	4.1
PUMP STICKING.....	4.1
INTERCHANGEABILITY.....	4.1
PACKAGE CONTENTS.....	4.1
PD3-F EQUIPMENT INDICATION.....	4.2
VISTAS TRASEIRAS DO PAINEL DE CONTROLE.....	4.5
SPARE PARTS AND ACCESSORIES LIST.....	4.7
STARTUP ASSISTANCE.....	4.8
TRAINING.....	4.9
SECTION 5 - TECHNICAL FEATURES	5.1
FUNCTIONAL SPECIFICATIONS.....	5.1
PHYSICAL SPECIFICATIONS.....	5.1
ORDER CODE.....	5.1
APPENDIX A - APPLICATIONS	A.1
FEED FORWARD CONTROL.....	A.1
CASCADE CONTROL.....	A.2

APPENDIX B - APPLICATIONS..... **B.1**
FEED FORWARD CONTROL B.1
CASCADE CONTROL B.2

Installation flowsheet



INSTALLATION

Waiver of responsibility

The contents of this manual complies with the hardware and software used in the current product version. It may eventually occur discrepancies between this manual and the product. The information in this document is periodically reviewed and the necessary or identified corrections shall be included in the following editions. We shall appreciate your suggestions for improvement.

ATTENTION

The client has 90 (ninety) days from the Fiscal Note issuing date to request a Smar technician to verify the Didactical Plant installation and startup, compliant to the **Startup Assistance** item in this manual. After this period, the customer must purchase this service separately, underwrite all expenses.

Warning

In order to preserve objectivity and clearness, this manual does not contain all the detailed information about the product and, furthermore, does not cover every possible cases for mounting, operation or maintenance.

Before installing and using the product, it is necessary checking if the acquired model really complies with the application technical and safety requirements. This verification is client responsibility.

If more information is desired or specific problems were not addressed or detailed in this manual, the user should seek information from Smar. In addition, the user is aware that the contents of this manual do not alter, whatsoever, past or present agreement, confirmation or judicial relation nor is part of them.

All Smar obligations result from the respective purchase contract between both parties containing the complete term of guarantee and sole validity. The contract clauses related to the guarantee are not limited or extended in reason of the technical information presented in the manual.

Only qualified personnel should be allowed on mounting, electrical connection, startup and product maintenance activities. Qualified personnel are understood as professionals familiar with these actions and those related to similar apparatuses, empowered with the profficiency to do so. Smar provides specific training to instruct and qualify such people. In addition, the safety procedures for the adequate mounting and operation of electric installations must be complied with, as well as the decrees and regulations on classified areas, such as intrinsic safety and explosion-proof areas, increased safety, instrumented safety systems, etc.

NOTE

Regarding the didactical plant, mechanical maintenance (except cleaning) should be carried out only by professionals authorized by SMAR.

The user is responsible for the incorrect or inadequate handling of equipment operated with pneumatic or hydraulic pressure, or subject to corrosive, aggressive or combustible products, as their use may cause serious body injury and/or material damage.

The field equipment that make up the PD3 is referred to in this manual. When these equipment include certification for classified or hazardous areas, they lose the certification when having their parts changed or exchanged without undergoing functional and approval tests by Smar or authorized technical assistance firms, which are the companies competent to attest that the equipment, as a whole, are compliant with the applicable directives and norms. The same applies when converting the equipment from one protocol to another. In this case, the equipment must be shipped to Smar or to an authorized dealer for the conversion. Besides, both certificates are distinct and it is the user responsibility to use them correctly.

Always respect the instructions included in this Manual. Smar is not responsible for any loss and/or damage resulting from the inadequate use of its equipment. It is also user responsibility to be familiar with the applicable local norms and safety practices.

NOTE

- 1- The requirements listed below must be considered before installing and operating the Smar Didactical Plant.
- 2- To adequately install the PD3, carry out these procedures in the indicated sequence:
 - 1st – Pneumatic Connections Procedures;
 - 2nd – Electrical Connections Procedures;
 - 3rd – Hydraulic Connections Procedures.

General

Requirements for installing and operating the Didactical Plant

- Two-phase 220 V + Ground – 5000 V / 23 A circuit;
- Compressed air supply point to fill the tanks;
- Draining water point to empty and clean the plant;
- Adequate plant structure space with size 2300 (L) x 2100 (A) x 1000 (P) (dimensions in mm).

Plant work with closed circuit

Generally the plant works through a closed circuit, i.e., without constant water consumption. Therefore, it is recommended only one water point for its filling and one draining point to carry out the water change and/or the tank cleaning procedure when necessary.

Mounting

Work station and peripherals

Connect the work station to the controller available at the plant or to the switch by using Ethernet cable.

NOTE

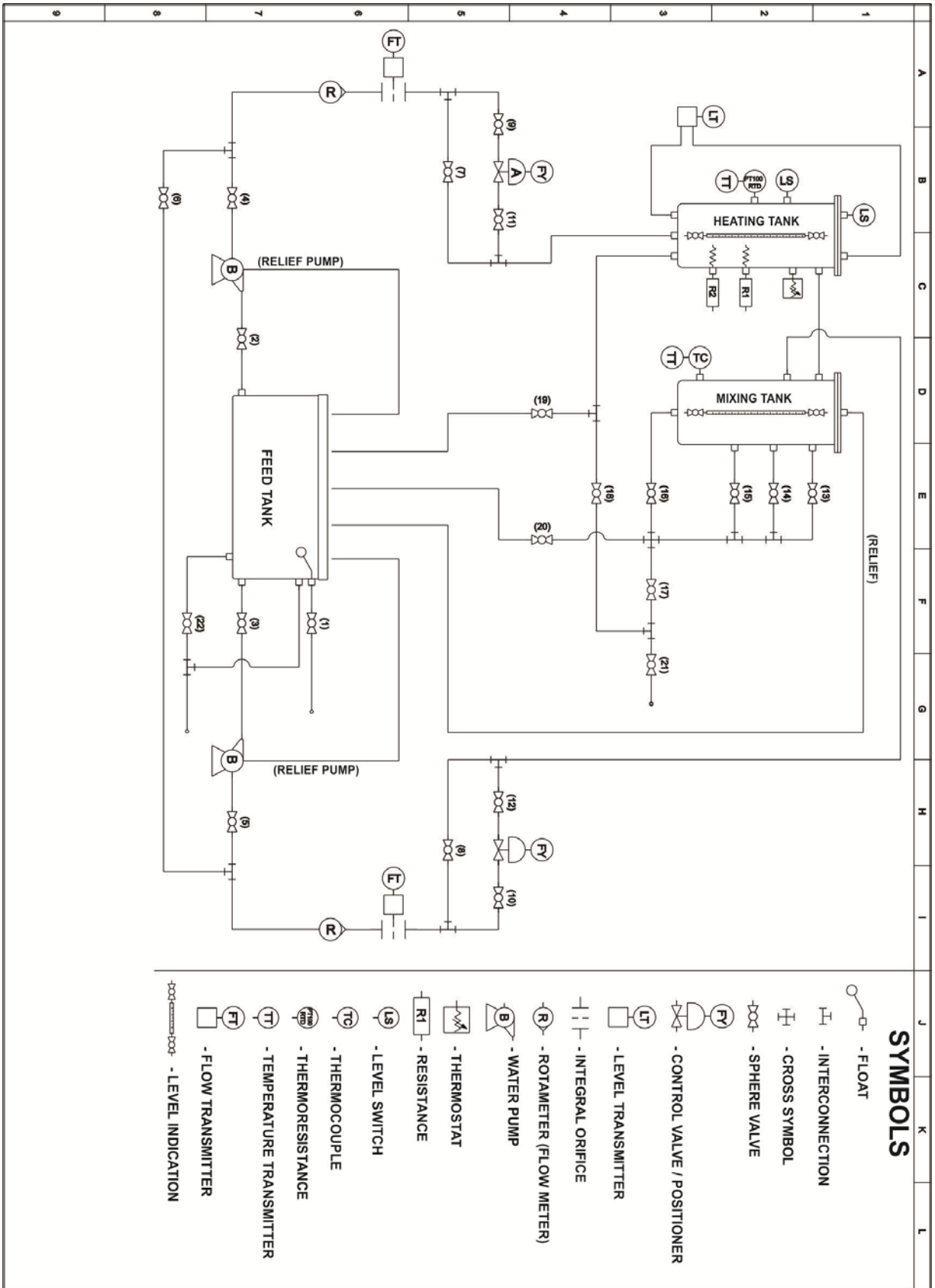
Refer to item: Net Configuration and Topology, in this section.

PD3 Dimensions



Figure 1.1 - PD3 Dimensions

Mechanical Flowsheet



Symbol	Description
	- FLOAT
	- INTERCONNECTION
	- CROSS SYMBOL
	- SPHERE VALVE
	- CONTROL VALVE / POSITIONER
	- LEVEL TRANSMITTER
	- INTEGRAL ORIFICE
	- ROTAMETER (FLOW METER)
	- WATER PUMP
	- THERMOSTAT
	- RESISTANCE
	- LEVEL SWITCH
	- THERMOCOUPLE
	- THERMORESISTANCE
	- TEMPERATURE TRANSMITTER
	- FLOW TRANSMITTER
	- LEVEL INDICATION

Figure 1.2 – Mechanical Flowsheet

Pneumatic Connections

The air supplied to the FY302 must be dry, clean and non-corrosive, with instrumentation quality. Consult the American National Standard "Quality Standard for Instrument Air" (ANSI/ISA S7.0.01 – 1996).

The FY302 is supplied with input and output air filters, but their presence does not replace the preliminary instrument air treatment.

Periodical cleaning of the filters every 6 months or less is recommended in case the instrument air quality is poor.

The FY302 air supply pressure must be a of a minimum 1,4 bar (20 psi) and a maximum 7.0 bar (100 psi).

However, the actuator minimum supply pressure, which is 4 bar (60 psi), must be observed. Below this range the pressure impairs the operation of the positioner + actuator set. Pressure above 7 bar (100 psi) may damage the set.

Both pneumatic outputs work in opposite directions to open or shut the valve.

IMPORTANT

If there is failure on the FY302, such as loss of air supply, the output signed with OUT1 (Output 1) moves to zero, moving the actuator to the closed position.

The positioner may be specified with manometers on the air supply input and on the OUT 1 output. The manometer indications are only qualitative and therefore less precise readings.

The pneumatic connections are marked with IN (input) for air supply and OUT 1, for Output 1. Use 1/4 NPT connections with thread sealing tape. Connect the air supply to the connection marked with IN (input). Check if the air supply does not exceed the maximum level allowed by the positioner or the actuator.

IMPORTANT

Avoid using sealing tape on the air inputs and outputs, as this material may release small residues and block them, thus impairing the equipment efficiency.

The **FY302** has five exhaustion orifices with filters. It is important that these outlets are not obstructed or blocked, as the air must circulate freely. In the event the positioner block is being painted, remove the filters to avoid their obstruction with paint. The orificies must be inspected regularly to make sure that the vents are not obstructed.

Simple Action

Connect the Positioner Output 1 (OUT 1) to the actuator input. Use a plug to shut the Output 2 (OUT2).

Air Supply

Before connecting the instrument air to the positioner, keep the hose open for 2 to 3 minutes to permit the elimination of any foreign matter.

Blow the air through a paper filter to catch any residues of water, oil or other contamination. If the test indicates that the air is impure, it must be replaced for a recommended instrument air (see recommendations on the subject).

As soon as the positioner is connected and initialized, the internal air flow will provide protection against corrosion and prevent humidity. For this reason, the air supply pressure must be always kept.



Figure 1.3 – Vinyl pipe inlet to supply air to the regulating filter.

Recommendations for an Instrument Air Supply System

The instrument air must be air of better quality than industrial compressed air. Humidity, suspended particles and oil may harm the device temporarily or permanently if the internal parts wear out.

In compliance with ANVISA S7.0.01-1996 – *Quality Standard for Instrument Air*, the instrument air must have the following characteristics:

Dew Point	10°C below the minimum temperature registered by the device.
Suspended particles size	40 µm (maximum).
Oil contents	1 ppm w/w (maximum).
Contaminants	Must be free from corrosive or flammable gases.

The standard recommends that compressor captivation be located on a site free of process spills, with adequate filter. Also, that the compressors used are non-lubricated to prevent the air from being contaminated by lubricant oil. When using lubricated type compressors, use resources to remove the lubricant from the air supplied.

A typical system for air supply and quality adequacy is shown at Figures 1.4 and 1.5.

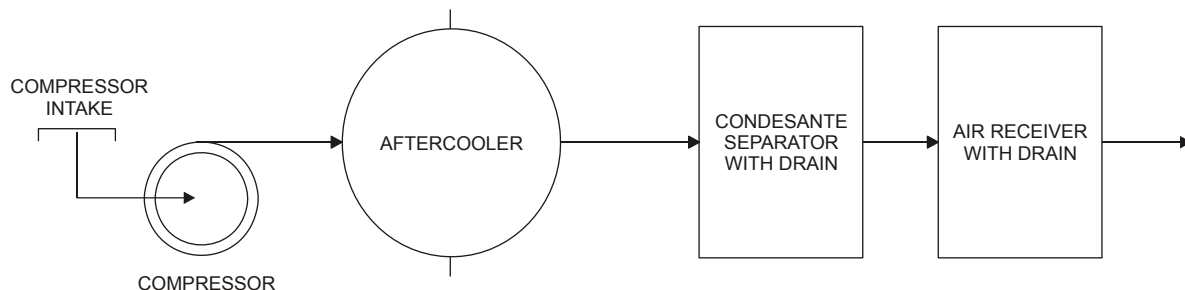


Figure 1.4 – Air supply system



Figure 1.5 – Air Quality Conditioning System

Pneumatic Connections Procedures

To carry out pneumatic supply the compressed air installation must be ready and set up by the client, according to the instructions below.

Connect a 1/4 vinyl pipe connector to the compressed air outlet of the installation to the plant regulating filter, according to Figure 1.



Figure 1.6 – Vinyl pipe connection to the regulating filter

Electrical Connections

The two-phase circuit breaker to be installed on the laboratory or class room must be of a minimum of 35 amperes.

Preferably use a **two-phase cable**, with each 4 mm² diameter **conductor and insulate the didactical plant housing on the grounding of the building** where the lab or class room is located. See figure 1.10 - Supply Diagram of the **housing ground bar**.

NOTE

The **two-phase cable** is optional and is not included in the standard set supplied by Smar.
The electrical connection of the didactical plan, recommended in this item, it is the customer's responsibility.

Electrical Connections Procedures

To set the electrical connections there must be a two-phase 220 Vac, previously installed by the client on the laboratory or the class room, according to the following instructions:

1 – Connect the two-phase cable to the didactical plant terminal block, as shown on Figure 1.7 and 1.10.



Figure 1.7 – Connection of the two-phase cable on the didactical plant terminal block

2 – Connect the other end of the two-phase cable with the male pin to the female socket at the lab or class room, as shown on Figure 1.8.



Figure 1.8 – Connection of the two-phase cable to socket.

Power Diagrams

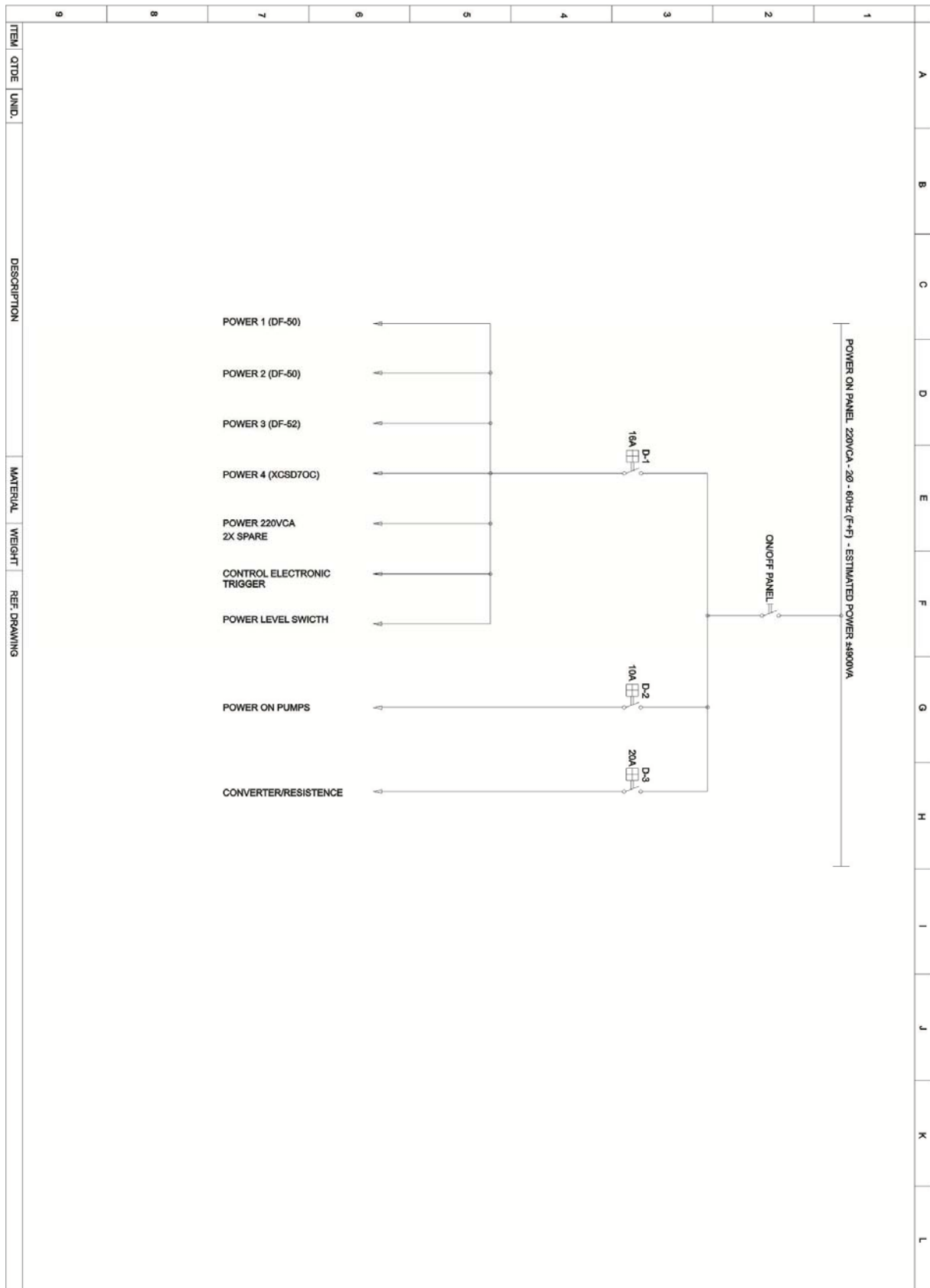


Figure 1.9 – Power Diagram – Unifilar Diagram

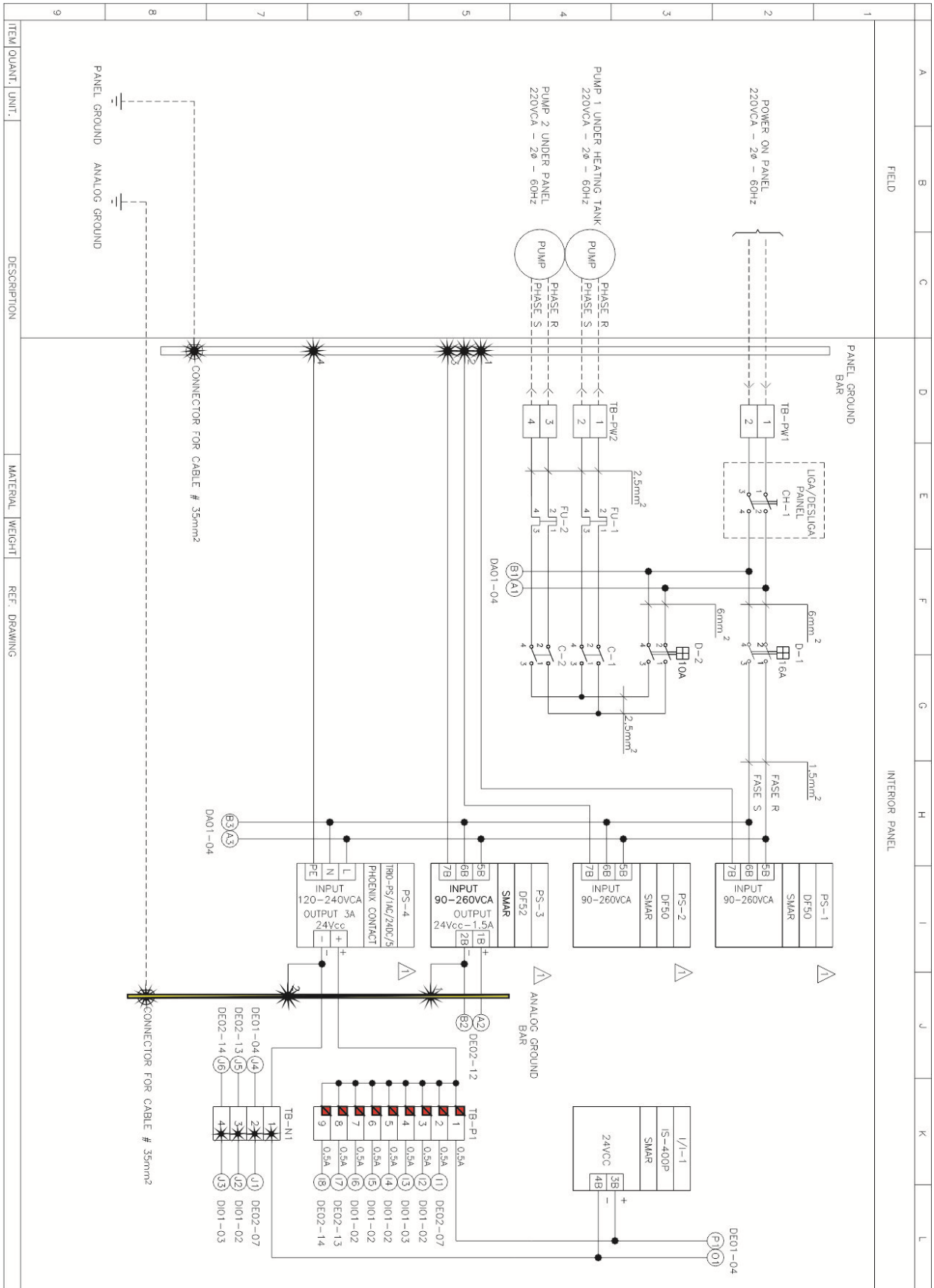
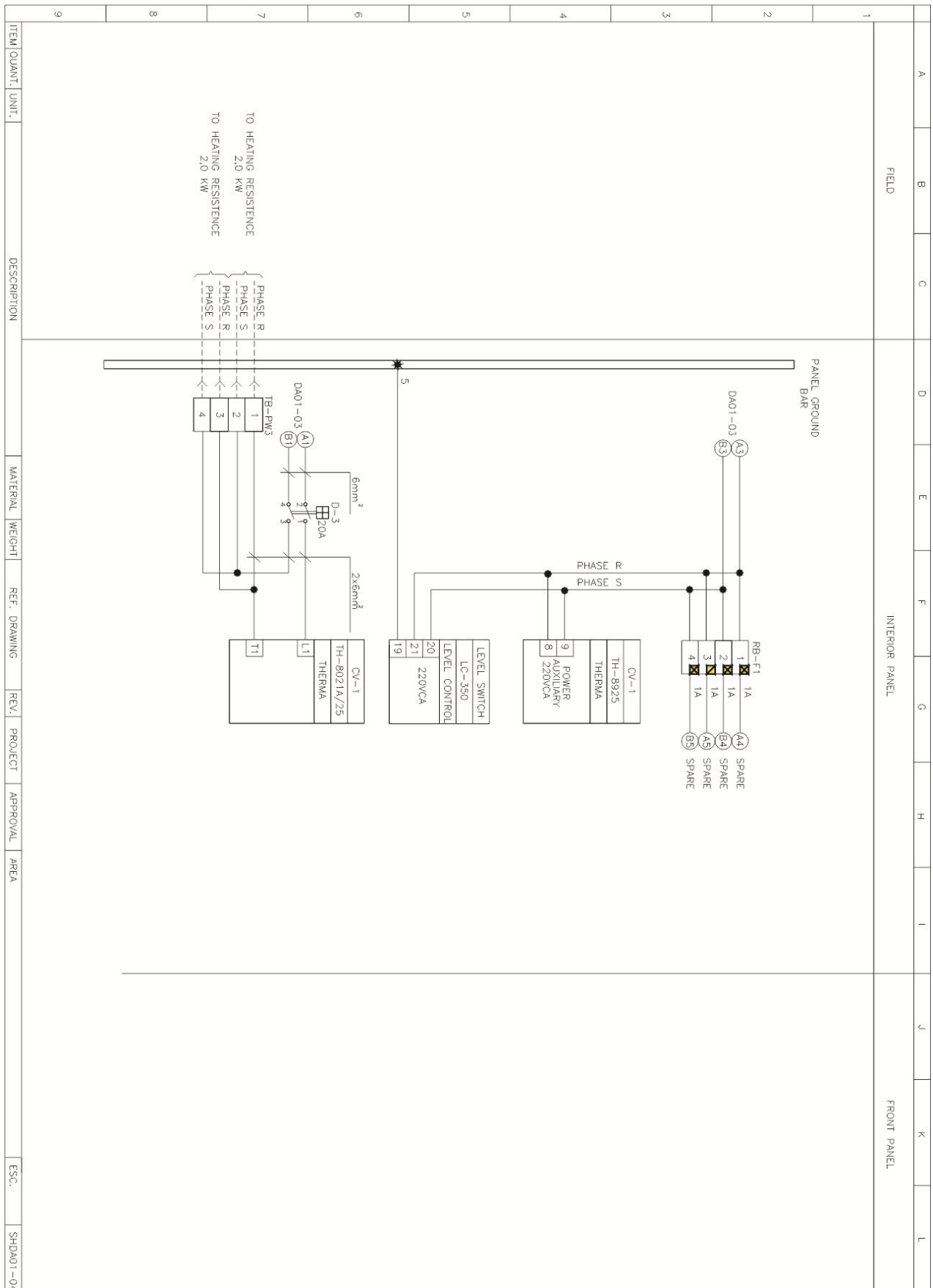


Figure 1.10 – Power Diagram



Water Supply

Figure 1.12 shows the location of the plant Water Drain Outlet and Water Supply Inlets



Figure 1.12 – Water Drain Outlet and Water Supply Inlets.

The plant water inlet and water drain work through a flexible hose, 1" diameter (to be provided by the client) on the connections installed in the lower part of the plant, as shown on figures 1.13 and 1.14.

The water supplied to the plant must be clean and pure, free from any suspended solids.

NOTE

Do not mix any type of additive or pigment with the water, to avoid damaging the equipment.

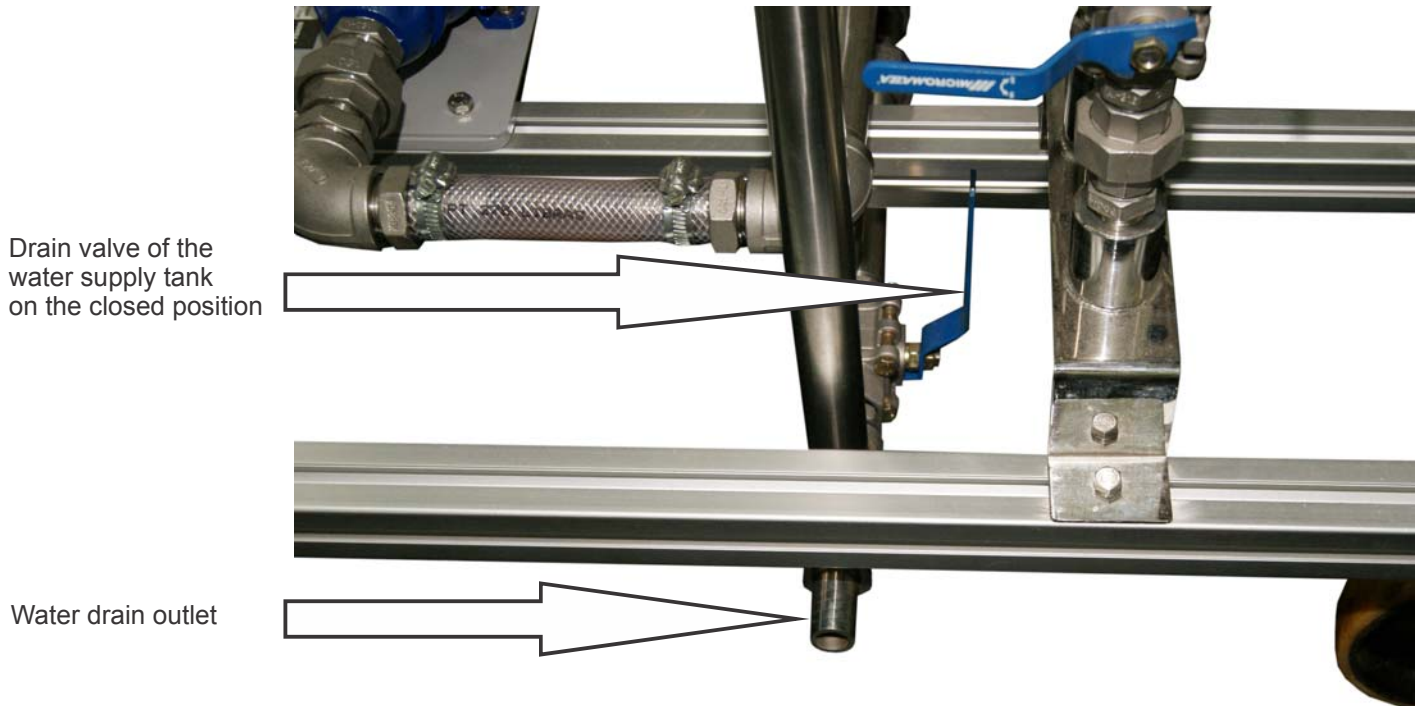


Figure 1.13 – Water drain outlet.

NOTE
On the figure below consider:
1 – Water supply inlet; 2 – Upper tanks drain

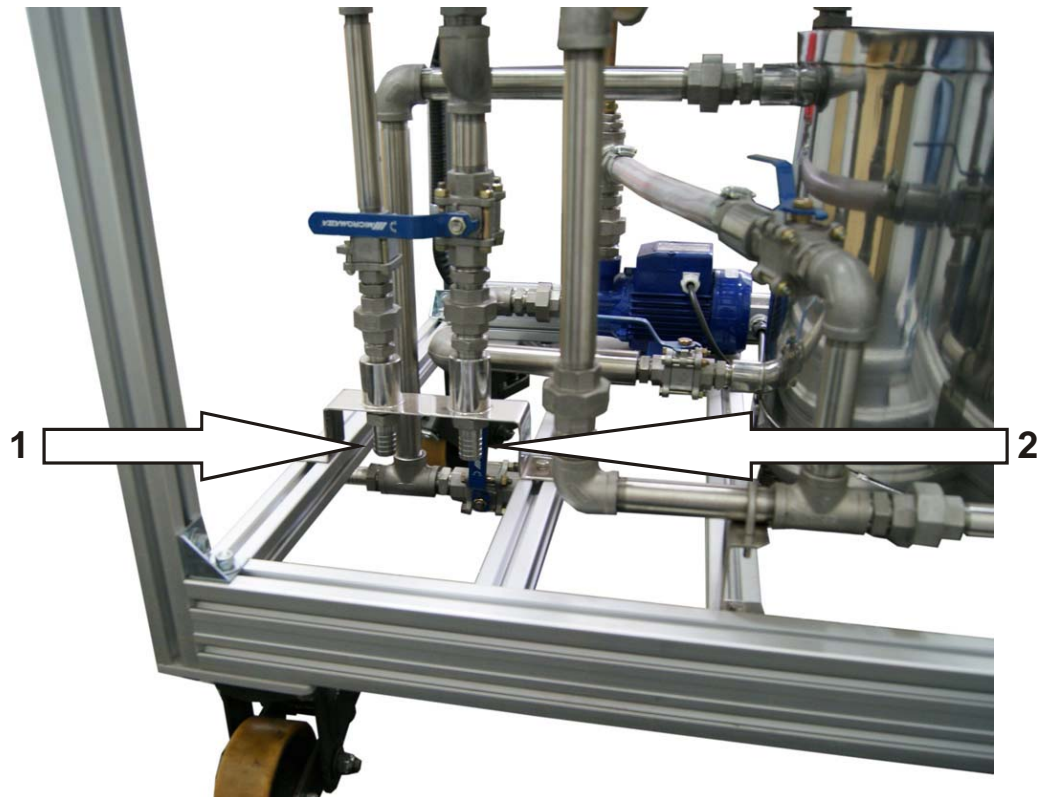


Figure 1.14 – Water supply inlets

Water connections procedures

To install hydraulic connections there must be a previous water point prepared by the client at the laboratory or the class room, according to the following instructions:

- 1 – Check if the tank drain valve is shut, according to Figure 1.13, in the previous item.
- 2 – Connect a hose of 1" diameter to the water inlet connection. The other end must already be connected to the water point valve or tap previously installed, according to Figure 1.14, in the previous item.
- 3 – Open the laboratory or class room water point valve or tap and watch the supply tank to be filled.
- 4 – When the internal water tank buoy is totally shut, the valve or tap on the lab or class room water point can be closed.

Network Configuration and Topology

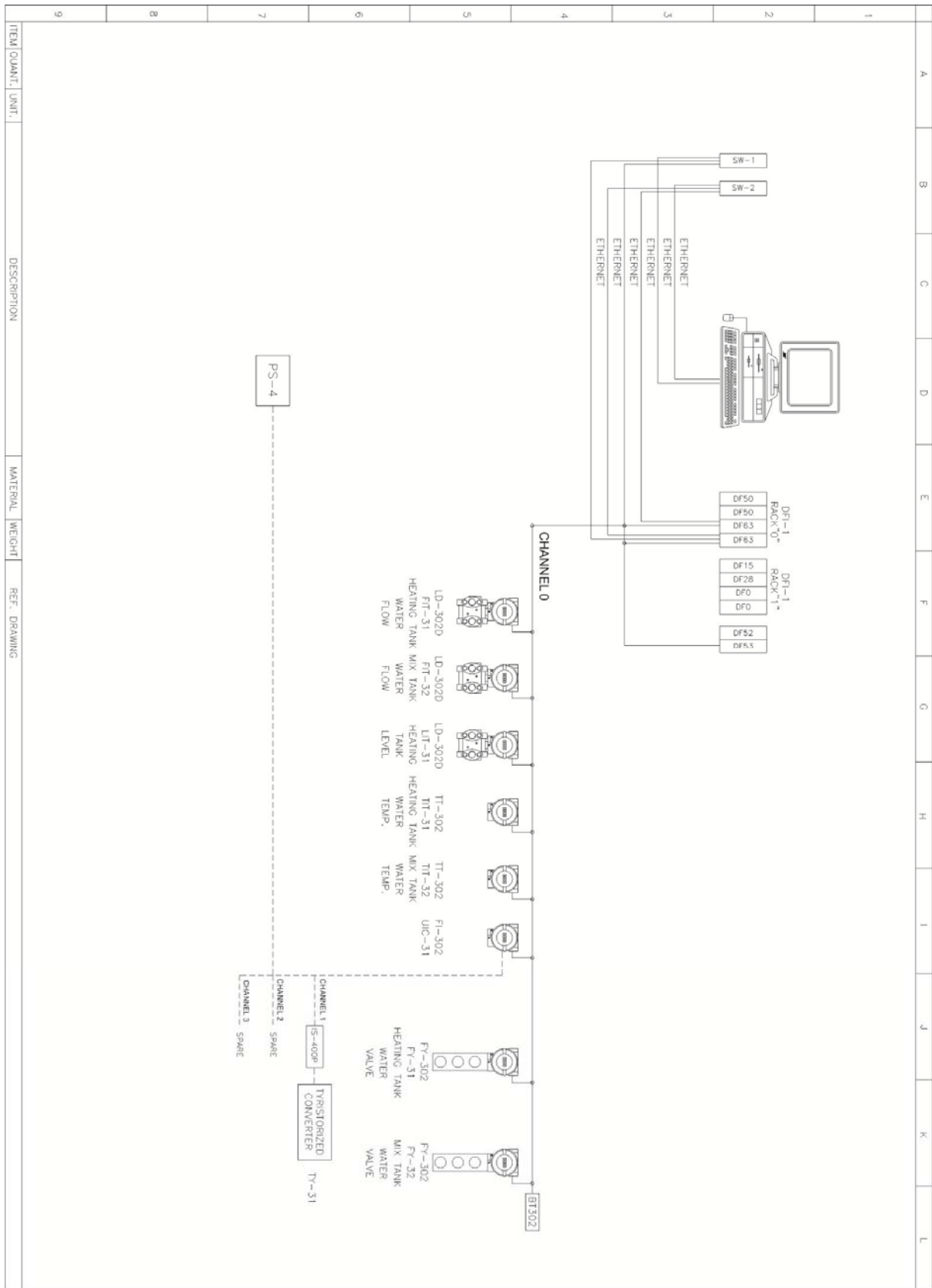


Figure 1.15 – FOUNDATION™ fieldbus Plant Digital Network Topology

Section 2

OPERATION

Didactical Plant General Features

Smar Didactical Plant has unique mechanical features. Its structure is totally made in alluminum so that it is light enough to be handled easily by two individuals, on a flat floor. None of its elements need to be removed or dismantled for the Didactical Plant to be transported over short or long distances and wheels on the structure base facilitate the displacement.

Tanks and piping are stainless steel made to prevent corrosion and ensure quality throughout time.

- Aluminum-made light structure;
- Base wheels facilitate displacement;
- Stainless steel-made tanks and piping;
- Front panel for startup and command;
- 10-valve three-part spheres of 1";
- 12-valve three-part spheres of 3/4".

To facilitate accessing the elements on the electrical startup and command, the controller front panel is arranged with the switches, buttons and signalers. Acrylic frames bear the Didactical Plant identification, user information and the principal control strategies related to it.

The Didactical Plant configuration, operation and supervision are carried out from a workstation, i.e., a microcomputer with software applications developed by Smar specifically for each industrial process stage. The SYSTEM302 Industrial Automation System enables the use of configuration and operation tools for equipment filling, by modifying transmitters and positioners internal values and altering the control loops operational modes.

The ProcessView supervising system integrated to the SYSTEM302 acquires data from the equipment and presents the information on the control loop through the graphic screens and animations. With the ProcessView it is possible to monitor and work on the system during operation. Both instructor and apprentice may create personalized synoptic screens, operational graphics and screen for identification of alarms and reports. The supervision station may be installed on a remote microcomputer connected in network with the workstation coupled to the Didactical Plant. This feature allows the process to be simoustanteously visualized by multiple users, on one or more remote supervision stations. (According to the license acquired).

The Smar Didactical Plant uses digital technology to execute temperature, flow and level control.

Didactical Plant Composition

The Didactical Plant is designed and manufactured with most instruments and controllers developed by Smar for the Foundation Fieldbus, Hart and Profibus technologies. Among them are pressure and temperature transmitters and valve positioners. See below the models of devices implemented according to the selected technology.

NOTE
See the specific manual for each Smar product on: http://www.smar.com.br

LD302 Pressure Transmitters

The differential pressure transmitters are used on level and flow measurements.

The LD302 is the Smar pressure transmitter for the FOUNDATION™ fieldbus protocol. To execute its programming, it uses the SYSTEM302 Industrial Automation System, which includes an integrated software with a set of tools for configuration, communication and maintenance of the equipment.

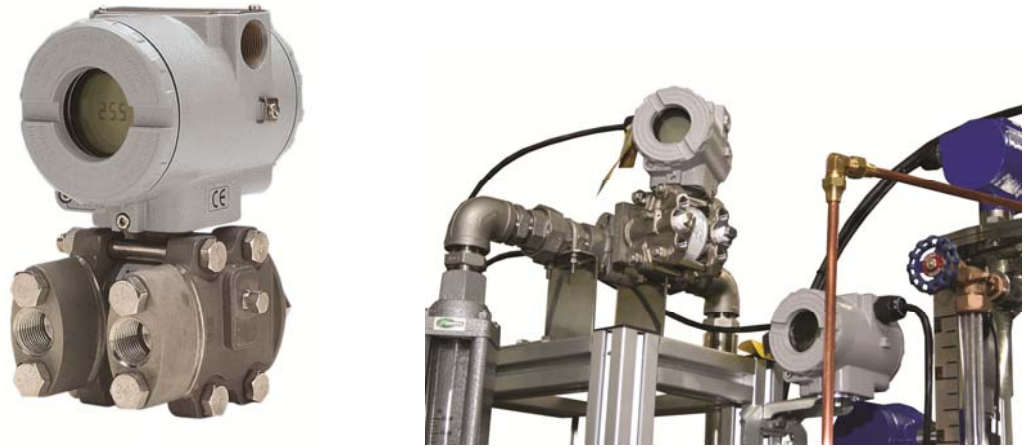


Figure 2.1 – Pressure Transmitter

TT302 Temperature Transmitters

SmAr temperature transmitters are intelligent, versatile and extremely powerful. Their digital technology allows that a simple equipment accepts different types of temperature sensors available in the market, like thermopar and thermoresistences, including load cells and resistive position indicators.

The temperature transmitter for the FOUNDATION™ fieldbus protocol is programmed with Industrial Automation SYSTEM302 tools.



Figure 2.2 – Temperature Transmitter

FY302 Valve Positioners

SmAr valve positioners use the most advanced microprocessor to execute exact and fast valve positioning. The FY300 Series positioners provide a pressure output for the actuator control valve and position it according to the input received from a controller.

The FY302 is a positioner based on the Foundation™ fieldbus protocol that is programmed by the SYSTEM302.



Figure 2.3 – Valve Positioner

Fieldbus/4-20 mA Converter

The FI302 converts the information from the FOUNDATION™ fieldbus protocol to a 4-20 mA current output. The control loop sends through one of its channels a current signal to the Power converter. Use the SYSTEM302 Industrial Automation System to configure the FI302.



Figure 2.4 - Fieldbus/4-20 mA Converter

DFI302 Process Control and Automation Platform

The DFI302 is a modular, flexible and multifunction platform with high processing capability that enables the communication and acquisition of process data with FOUNDATION™ fieldbus and PROFIBUS protocol equipment. The DFI302 modules are designed for complete solutions of network distribution, including configurations and network analysis, device parameterization and data acquisition.

The **DF63** is a multifunctional controller with gateway functions between H1 independent and HSE networks, in addition to Modbus communication. It has capability for flexible blocks instantiation and configuration through Ladder language.

The **DF75** module is a HSE controller whose main purpose is to associate discrete control to continuous control using FOUNDATION™ fieldbus functional blocks. By means of I/O cards it executes discrete control via ladder logic and permits communication between the Field devices besides Modbus communication.



Figure 2.5 – DFI302 Process Control and Automation platform

Ethernet Switch Module

This module permits connecting the DF63 (CPU) module directly to a local Ethernet 100 Mbps (LAN) network.

DF54 Twisted Pair Cable

100 Base-TX twisted pair cable

IS400P Signal Distributor Insulating Module

It is an auxiliary device designed to galvanically insulate a current or voltage signal issued by a receptor device, typically a register or controller. Furthermore, the power supply module is also insulated both on the input and the output.

The IS400P Signal Distributor Module solves the problem of distortions on the signal transference due to different ground potentials.

It may also be used on two-wire transmitter power supply.

Power Supply Module

This is a source that works independently to guarantee continuous power supply to the application.

This module has a voltage output with 24 Vdc and 3 A for external use.

BT302 – Fieldbus Bus Terminator

The fieldbus transmitter frame is done by the current modulation and the reception frame is done by the voltage perceived.

The main function of a terminator is to avoid the reflection of the transmission signal. On an infinite signal transmission line with characteristic Z_0 impedance, the communication signals flow on a single direction. In case the line has a junction, there is an impedance unmatching (when the input impedance is different from the characteristic line impedance). So, the signal meets a barrier, which causes a signal reflection with amplitude proportional to the unmatching. This reflection, with opposed direction to the transmitted signal, will superpose to the signal and cause serious distortions on the original signal. If the impedance matches on all line ends and junctions, the reflection effect will be eliminated, as if the line were infinite.

By standard, a Fieldbus line must have a characteristic Z_0 impedance of $100\Omega \pm 20\%$ @31,25 KHz and the terminators must have an impedance of $100\Omega \pm 2\%$, considering the frequency range of 7,8 KHz to 39 KHz ($0,25 \times 31,25$ KHz to $1,25 \times 31,25$ KHz).



Figure 2.6- Fieldbus Bus Terminator

DF50 – Backplane Source

This redundant power supply source works independently or jointly with other redundant source to ensure constant supply to the application.

When two power sources are used redundantly, if one of them fails, the other takes over the supply automatically. Each power source has a relay to indicate possible failures and provide the user with a substitute for the damaged source.

This module has two voltage outputs: 5 Vdc @ 3A: distributed by Power Lines on the Inter-Module-Bus (IMB) through the racks to power the module circuits;

24 Vdc @ 300 mA: for external use through terminals 1B e 2B .
The AC power source voltage, the 5 Vdc and the 24 Vdc are insulated.

DF52 – Fieldbus Network Power Source

Is a non-intrinsic safety equipment with one universal AC input (90 to 264 Vac, 47 to 63 Hz or 127 to 135 Vdc) and 24 Vdc insulated output with protection against overcurrent and short circuit, besides failure indication, appropriate to power the fieldbus elements.

DF53 - FOUNDATION™ fieldbus impedance with 4 channels

This impedance implements an output circuit whose impedance is bigger than 3 K Ω and parallel to two terminators of 100 Ω \pm 2% each results in a line impedance of approximately 50 Ω . This impedance can be implemented in a passive mode (50 Ω resistance in series with 100 mH inductance) or in an active mode (through a circuit to adjust the impedance).

ProcessView Supervision Software

The ProcessView is a software for supervision entirely integrated to the SYSTEM302 that enables creating user-configurable graphic interfaces in a way that complies with each plant specific needs. The Smar Didactical Plant has pre-configured hierarchy screens that show a group and details general view, as well as other common screens like: sinoptics, history and real-time record, alarm and events record, etc. The ProcessView collects data from the Didactical Plant equipment to enable them on the Workstation screen. And moreover, the ProcessView data base is easily configurable.

SYSTEM302 Configuration and Control Platform

Developed in a innovative way and focused on results, the SYSTEM302 offers unparalleled, safe, competitive advantages with operational excellence. Its principal features are:

- A corporate solution that allows the integration of the control, information and corporate systems.
- Scalability and flexibility for architecture expansion to meet production demands;
- Provides compact, robust, safe and totally integrates projects;
- Asset management that through digital communication facilitates the plant data collection, storing them on a single data base, making them available anywhere, any moment;
- Total connectivity of open automation technology recognized the world over. Infrastructure based on HSE (High Speed Ethernet) networks permits the connectivity of several protocols like FOUNDATION™ fieldbus, HART®, AS-i, DeviceNet, Modbus, PROFIBUS-DP/PA, OPC, DNP3, among others;
- Real-time data analysis allows fast corporate decision making focused on reaching the best results.

The SYSTEM302 has a complete applications platform for configuration, operation, maintenance and control systems analysis. To see all the system tools consult the specific SYSTEM302 manual, available on [HTTP://www.smar.com.br](http://www.smar.com.br).



Figure 2.7 – SYSTEM302 Process Control System

Other Included Equipment

Besides the equipment and the software tools developed by Smar, the Didactical Plant has also third-party made equipment.

NOTE

See the specific product manual according to the manufacturer.

Optional Frequency Inverter

This electronic device transforms fixed electrical AC energy (voltage and frequency) in variable AC energy. This voltage and frequency variation makes it possible to control electric motor rotation. The equipment is used on the Didactical Plant to control the rotation of the mixing tank pump.

Hydraulic Pumps

Two hydraulic pumps activate the water circulation on the Plant Didactical piping and tanks. The pumps have high output, easy operation and maintenance, besides being compact and silent.

Control Valves

Two globe type control valves control the Didactical Plant water flow.

Water Rotameter

The two Didactical Plant rotameters indicate the instantaneous value of the water flow on the respective circuit.

Thermoresistance Temperature Sensor

The Pt100-IEC type temperature sensor measures the water temperature in the hot water tank.

Thermopar Temperature Sensor

The Thermopar type temperature sensor measures the water temperature in the mixing tank.

Level Switch

Detects the low level of the hot water tank, by issuing a command to the control panel to inhibit, via the static converter, the electrical energy transferred to the electrical resistances inside the tank, thus preventing the resistances from burning.

Static Converter

This converter is used to Power the electrical resistances that heat the water.

Thermostat

The thermostat is located in the hot water tank and sends a signal to inhibit the static converter when the temperature reaches high temperature limit.

Local adjustment magnetic switch

A tool for local adjustment through the activation of a reed switch.

Flow measurements integral orifice

It is a primary element for flow measurements that produces a pressure difference. Through this difference the differential pressure transmitter measures and indicates the flow that passes through the process pipes.

Immersion Resistance

It is the electrical resistance inside the heating tank to heat the water. So it is possible to work with the temperature control loops.

Piping, connections, screws and bolts

The piping for the didactical plant main water lines as well as the threaded and flanged connections on the 3/4" and 1" gauges are made of stainless steel AISI-304.

The mounting screws, washers and bolts on the supports and tanks structure, are made of AISI-304 stainless steel.

The manoeuver sphere valves on the 3/4" and 1" gauges are made of CF8 stainless steel and their mounting screws are made of bichromatized carbon steel.

The pumps relief lines, tanks vents and impulse lines on the level transmitters are made of copper

pipng and brass flanged connections.

Metallic table

The metallic table is the structure that supports the plant fixed elements and where the mechanical and electrical devices are mounted, such as measurement and actuation equipment, piping, electrical mounting board, conduits, buffer wheels and tanks. The table material is made of aluminum, which adds three positive characteristics: rigidity to support all the elements, lightness for easy displacement and sophisticated design.

Mixing Tank

It is where hot water coming from the heating tank is mixed with cold water that comes from the supply tank.

Reservoir Tank – Supply

It has the following functions:

1. Receive the water supplied to the didactical plant;
2. Receive the returned water from the mixing tank;
3. Receive the returned water from the heating tank after draining;
4. And it drains all the water to the sewer system for plant cleaning or even for substituting the water that circulates in the plant.

Buffer Tank

Buffer tanks are those mounted on the pumps output lines to avoid pulsation on the output flow if necessary.

Mounting board with buttonholes

Buttonholes are electrical switches activated manually, generally having one open and one closed electrical contact.

Signalers

Visual or audible way of calling the operator attention in a given situation in a circuit, machine or set of machines.

It works through a horn and colored light signals according to the specific standard.

Terminal blocks

Electrical terminal blocks or rulers are the points where the didactical plant electrical components interconnect with equipments as plant power supply, measurement equipment, immersion resistances etc.

Thermic relays

A protection device against electrical overload applied to an electrical motor. This device prevents motor bearings overheating when the circulating current exceeds its limit.

Protection

Acrylic plates installed on the sides of the control panel for electrical circuit protection.

PD3 Functional Description

Control Loops

Smar Didactical Plant allows the instructor and the apprentice to implement several control loops in a simple and intuitive way, by using the SYSTEM302 Industrial Automation System. Smar also supplies control loops to be installed and configured on the supplied didactical plant.

Anticipative Control

The Anticipative Control is a control that measures the disturbance based on a setpoint value for the controlled variable. The needed value is calculated for the handled variable in a way that prevents the controlled variable from being altered. See example on Figure 2.8.

Negative Feedback Control

The feedback concept consists of three basic functions. The variable to be controlled is measured, the measurement is compared with a setpoint and its difference is the error signal and finally a process variable is adjusted or handled to reduce or eliminate the error signal.

The purpose of this control is to keep the temperature on the heating tank at a fixed value. A power

converter is the final control element, one that is responsible for sending energy for a group of electrical resistances to heat the tank water. The main loop is the temperature loop which after ending the control receives a gain originated from the water flow to accelerate the power demand necessary for keeping a constant temperature. This strategy guarantees that the variations arising from the heating tank input get rapid response.

Through the synoptic screen the temperature loops may be adjusted, as shown on the figure example.

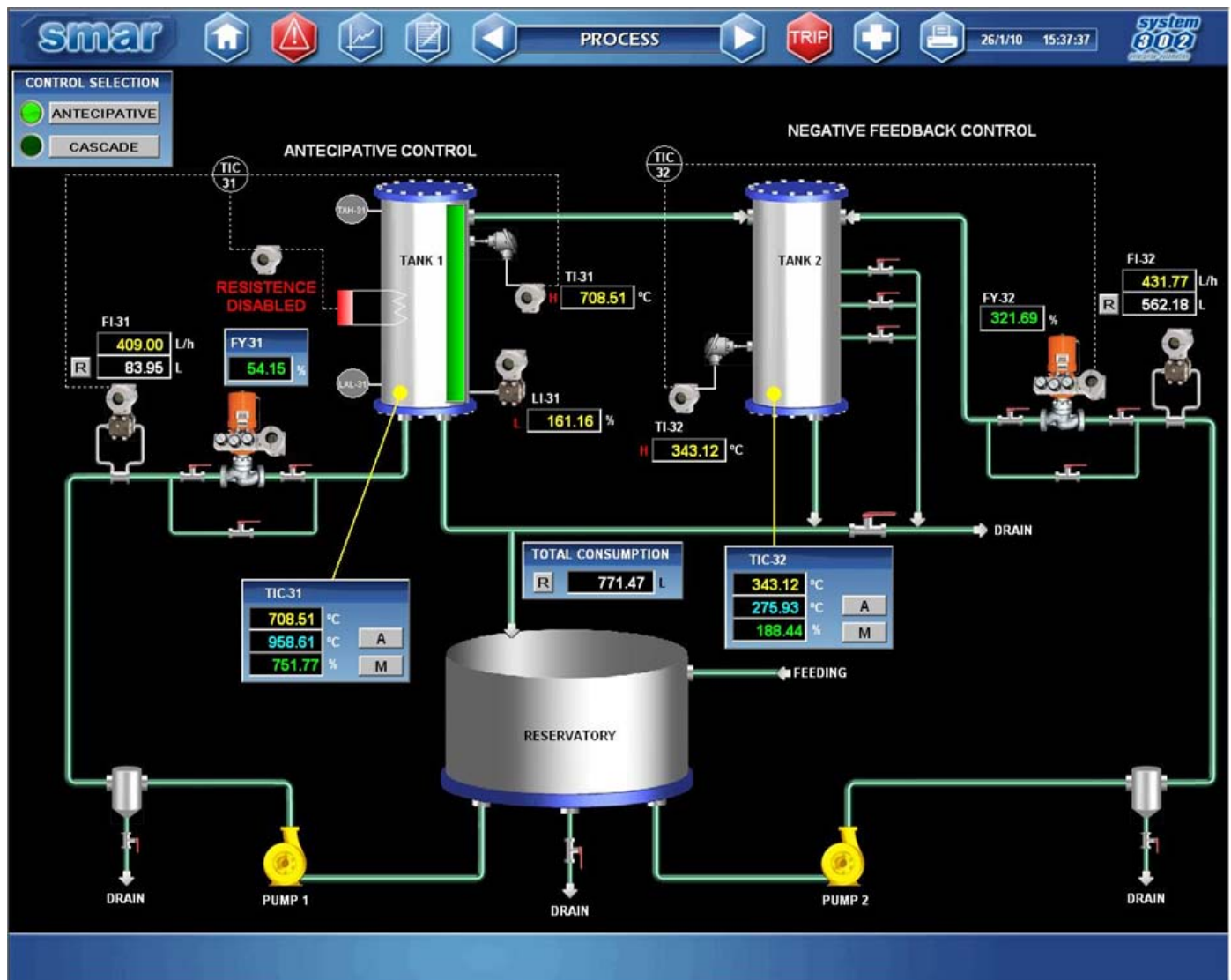


Figure 2.8 – Anticipative Control and Negative Feedback Control

Cascade Control

This is a simple method combining two controllers by series feedback. The cascade control is defined as the configuration where a controller output signal is the setpoint of at least another controller.

In the mixing tank, the hot water coming from the heating tank is mixed with cold water to heat it. The purpose of this control is to keep the water temperature in the mixing tank responsive to the temperature variations of the heating tank water. The cold water flow loop receives for setpoint the output of the temperature control on the mixing tank, thus stirring the cold water valve action when the temperature is different from the requested one.

The synoptic screen enables adjusting the temperature and the flow loops, as shown on the figure below:

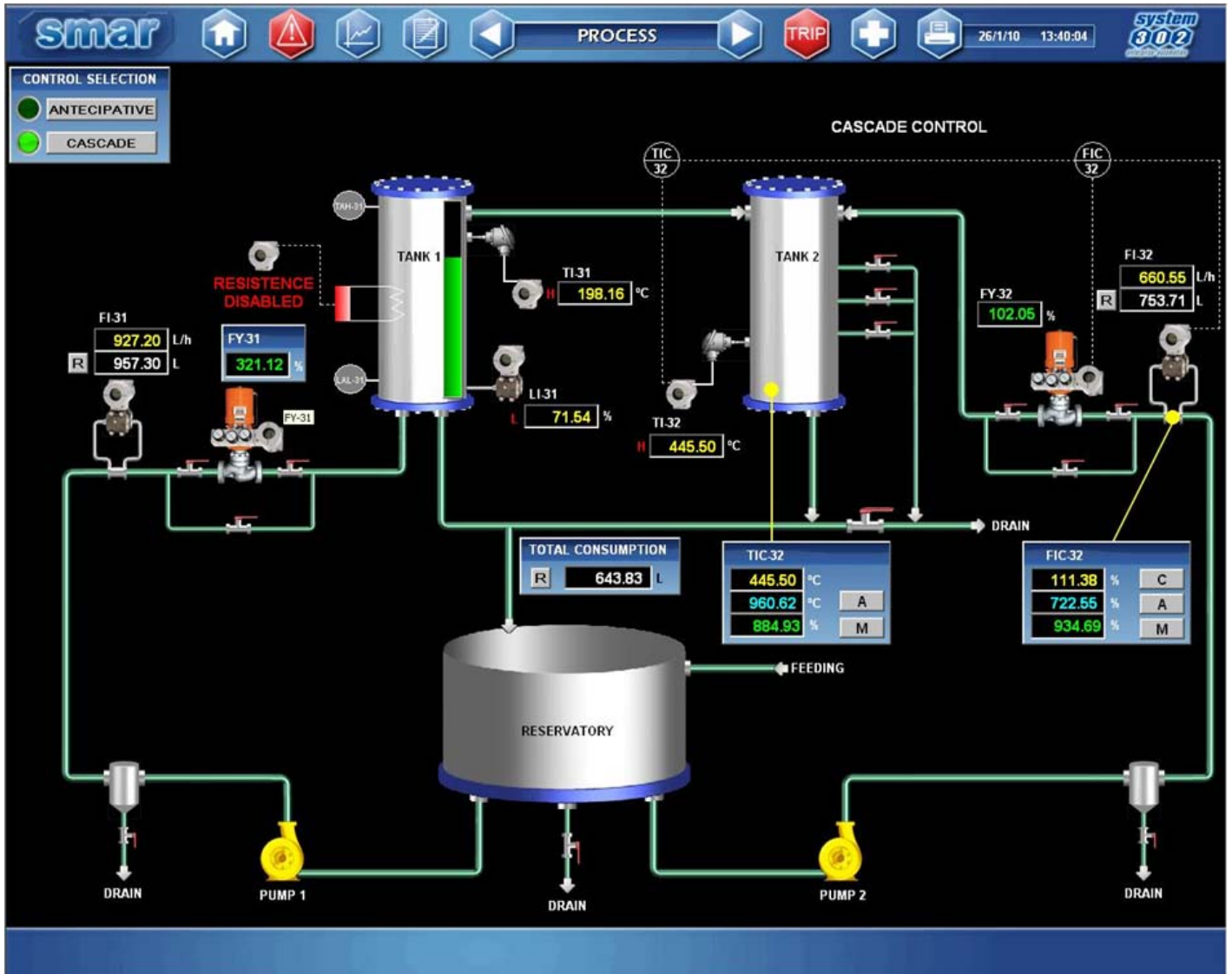


Figure 2.9 – Cascade Control

Circuit Functional Description

P&I Diagram

NOTE

The Didactical Plant maintenance requires the use of Individual Protection Equipment (EPI) adequate to execute the task in compliance with standard NR-10.

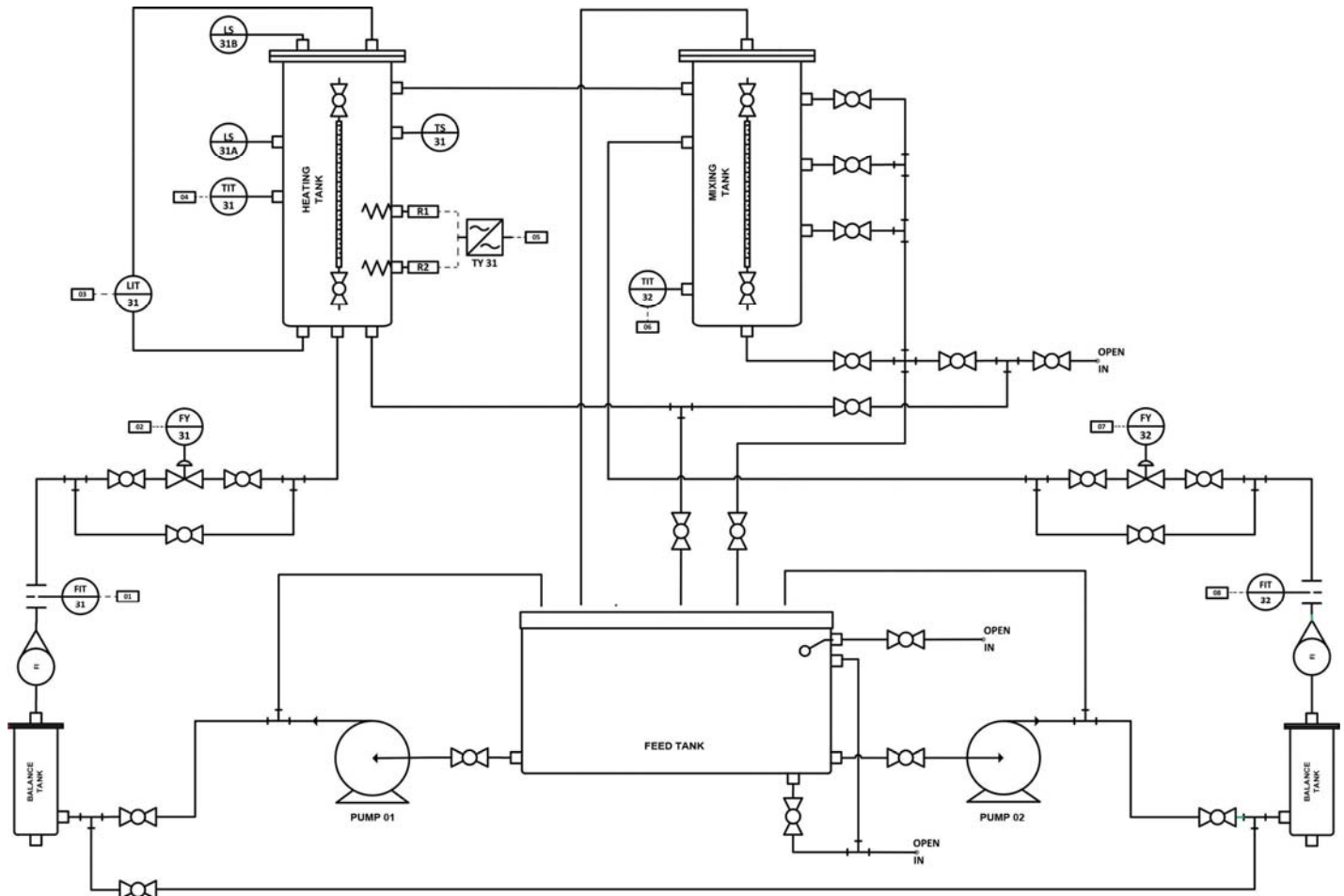


Figure 2.10 – P&I Diagram

CONFIGURATION

The configuration, operation and supervision of the Smar Didactical Plant are executed from a workstation, namely, a microcomputer with software applications developed by Smar, specifically for each stage of the industrial process. Through the SYSTEM302 Industrial Automation System, the configuration and operation tools are used to work on the equipment records, by modifying internal values of transmitters and valves and altering the control loops operational modes.

The ProcessView supervision system integrated to the SYSTEM302 executes the equipment data acquisition and presents control loops information through the graphic screens and animations. The ProcessView enables monitoring and working on the system while in operation. Both the instructor and the apprentice may create personalized synoptical screens, operational graphics, screens for acknowledgment of alarms and reports.

The supervision station may be installed on a remote microcomputer connected in network with the workstation coupled to the Didactical Plant. This feature allows the process visualization by multiple users simultaneously on one or more remote supervision stations. The Smar Didactical Plant employs analog or digital technology for temperature, flow and level control.

Workstation

The PD3-F Didactical Plant requires a Workstation (an external computer) to execute configuration, operation and monitoring.

NOTE

The workstation (microcomputer, monitor and printer) is an optional item and is not included in the standard set supplied by Smar.

System Requirements

To install and execute the SYSTEM302 Industrial Automation system, a few minimum requirements are needed when the workstation is acquired. The system performance will be efficient if these minimum requirements are met at the workstation acquisition.

See them below for adequately operating the SYSTEM302 and the Smar Didactical Plant.

• Operating Systems Supported:

- Windows Server 2003 x86 Service Pack 2;
- Windows XP Professional x86 Service Pack 3;
- Windows 7 64 bits Professional (runs in 32-bit compatibility mode);
- Windows 7 64 bits Ultimate (runs in 32-bit compatibility mode);
- Windows 7 64 bits Enterprise (runs in 32-bit compatibility mode);
- Windows Server 2008 64 bits Service Pack 2 (runs in 32-bit compatibility mode);
- Windows Server 2008 x64 R2 (runs in 32-bit compatibility mode).

• Minimum Requirements:

Windows XP or Windows Server 2003:

- 1.5 GHz Processor (CPU) or higher;
- 2 GB Physical Memory (RAM);
- 5 GB Hard Disk space available;
- DVD optical drive;
- SVGA Video Card; 256 or more colors for best results;
- A mouse or other compatible pointing device (such as a trackball or touch screen);
- Microsoft-compatible keyboard;
- Microsoft Internet Explorer 6.0 or higher.

Windows 7 or Windows Server 2008:

- 2.0 GHz Processor (CPU) or higher;
- 2 GB Physical Memory (RAM);
- 5 GB Hard Disk space available;
- DVD optical drive;
- SVGA Video Card; 256 or more colors for best results;
- mouse or other compatible pointing device (such as a trackball or touch screen);
- Microsoft-compatible keyboard;
- Microsoft Internet Explorer 8.0.

Software

NOTE

See each specific manual for Smar software on the website [HTTP://www.smar.com.br](http://www.smar.com.br)

Configurations and Control Strategies Software

SYSTEM302 Process Control System

The SYSTEM302 is the most modern distributed control automation system. Developed in innovative way and focused on results, the SYSTEM302 provides to different industrial segments unequalled, safe and competitive advantages with operation excellence. The SYSTEM302, with its transparent integration with advanced information systems like MES (Manufacturing Enterprise Solutions), PIMS (*Process Information Management System*) and ERP (*Enterprise Resource Planning*), turns field information into business intelligence. This well structured and organized type of automation, hierarchically positioned inside the companies, permits the connection of different data sources – commercial, supplies and production.

Business portals for identification and follow-up of production performance, such as KPI (*Key Performance Indicator*) and OEE (*Overall Equipment Effectiveness*), may also be constructed. The information is provided in network, in versatile and safe way, as support for wireless devices or through the Internet.

Developed in innovative way and focused on results, the SYSTEM302 provides unequalled, safe and competitive advantages with operation excellence. Its main features are:

- Company solution that permits the integration of control, information and corporate systems;
- Scalability and flexibility for architecture expansion to meet the production demands;
- Provides totally integrated, compact, robust and safe projects;
- Asset Management through digital communication facilitates collecting plant information and store them on a single data base, while enabling them anywhere, any time, in the company.
- Total connectivity of open automation technologies recognized worldwide and infrastructure based on HSE networks (High Speed Ethernet) permits connecting multiple protocols such as: FOUNDATION™ fieldbus, HART®, AS-i, DeviceNet, Modbus, PROFIBUS-DP/PA, OPC, DNP3, among others;
- Real-time data analysis allows fast corporate decision making focused on the best results.

The SYSTEM302 has a complete platform of applications for configuration, operation, maintenance and analysis of control systems.

The SYSTEM302 works on Windows platform and system administrator rights are required to install the software. After installed, the system needs license from Smar to use the system tools.

The SYSTEM302 license that comes with the didactical plant is provided by a hardkey that contemplates 500 points both for configuration and the server. This is a standard license that can be customized upon the client's request.

Supervision Software

ProcessView – Set of IHM and SCADA Applications Enables for the Internet

Advanced component for process visualization, data acquisition, alarms, analysis of trends, batch control and much more. The ProcessView is the standard option for the SYSTEM302 workstation operational package. It is modular and is provided with three basic packages: GraphWorkX, AlarmWorkX and TrendWorkX. They are responsible for process visualization, alarm acquisition and management, and trend management, respectively.

- Easy configuration, visualization and maintenance, including support to the Alarm & Events OPC Server;
- Compatible with multiprocessing stations and multimedia resources for PDA and SmartPhone;
- Advanced data mining functions;
- Resource for history reproduction and trends in video form;
- Possibility of local language configuration for use on the client station, regardless of the server language;
- Optimized module for recipe management;
- SNMP connector and time stamp through the field device or local time server;
- Support to SQL Express 2005 SP2.

The ProcessView that accompanies the didactical plant is provided with a hardkey that contemplates 500 supervision points. This is a standard license that may be customized upon client's request.

Section 4

MAINTENANCE

General

Provides information on how to identify problems and their solutions, as well as PD3 maintenance procedures.

NOTE
The PD3-F water supply must be done with clean water only.

Dismounting Procedure

The plant should only be dismantled by Technical Assistance service authorized by Smar. In case of any physical intervention performed by non-authorized persons, it will be at the client's sole responsibility.

Cleaning Procedure

Hydraulic System

The piping and water tanks must be drained when the water acquires dark aspect, as if it were "rusty".

Cleaning must be carried out with clean water, without the addition of chemical products or one that leaves residues.

When the PD3-F is out of use, the water supply tank must be covered for protection to prevent dirt or insects.

Pump Sticking

To prevent pumps from sticking it is recommended that the user activate them at least once a week for a minimum of 30 minutes to circulate the water by the plant.

Interchangeability

The replacement of device boards or firmware that make up the didactical plant should be carried out according to each specific device manual. The substitution must be carried out only by people authorized by Smar.

Package Contents

When acquiring the Didactical Plant, the client will receive the four DVD-ROM listed below plus two Hardkeys containing the software license.

NOTE
It is the client's responsibility to keep and maintain the Hardkeys with the software license. In case of Hardkey damage or loss, the client must acquire new licenses for the software.

Check the contents of the PD3-F packaging:

- SYSTEM302 DVD-ROM;
- ProcessView DVD-ROM;
- Device Library DVD-ROM;
- DVD-ROM for the instruction manuals of the equipment produced by Smar, including the PD3-F manual;

- 2 magnetic screwdrivers;
- 1 Hardkey with licences for 500 System302 points
- 1 Hardkey with licenses for 500 ProcessView points

PD3-F Equipment Indication

For more details, refer to the Mechanical Flowsheet on Section 1 in this manual.

NOTE

The numbers indicated on the figure below relate to the POSITION indication of the Didactical Plant on the RELATION OF SPARE PARTS AND ACCESSORIES table, in this section.

Front View



Back view



Side view

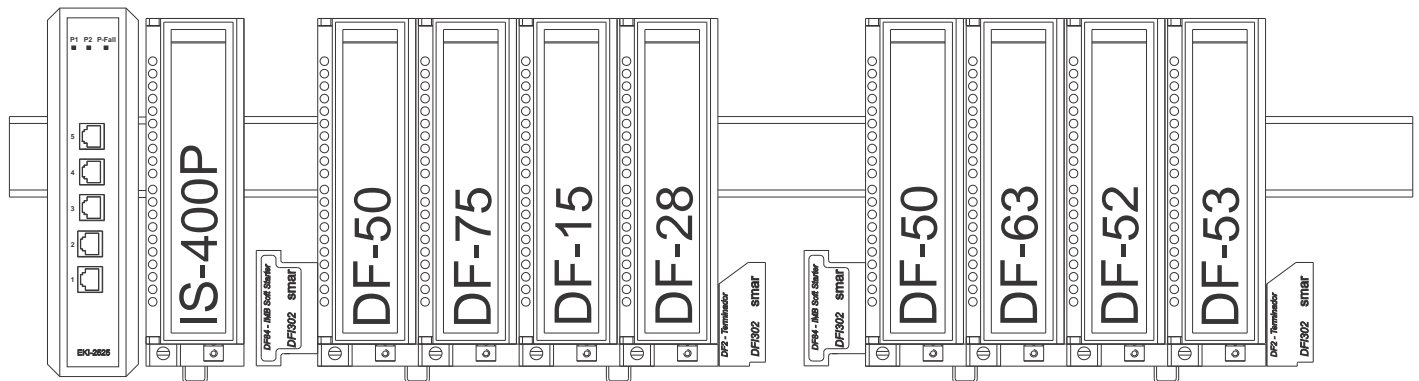
Right



Left



Control Panel modules scheme



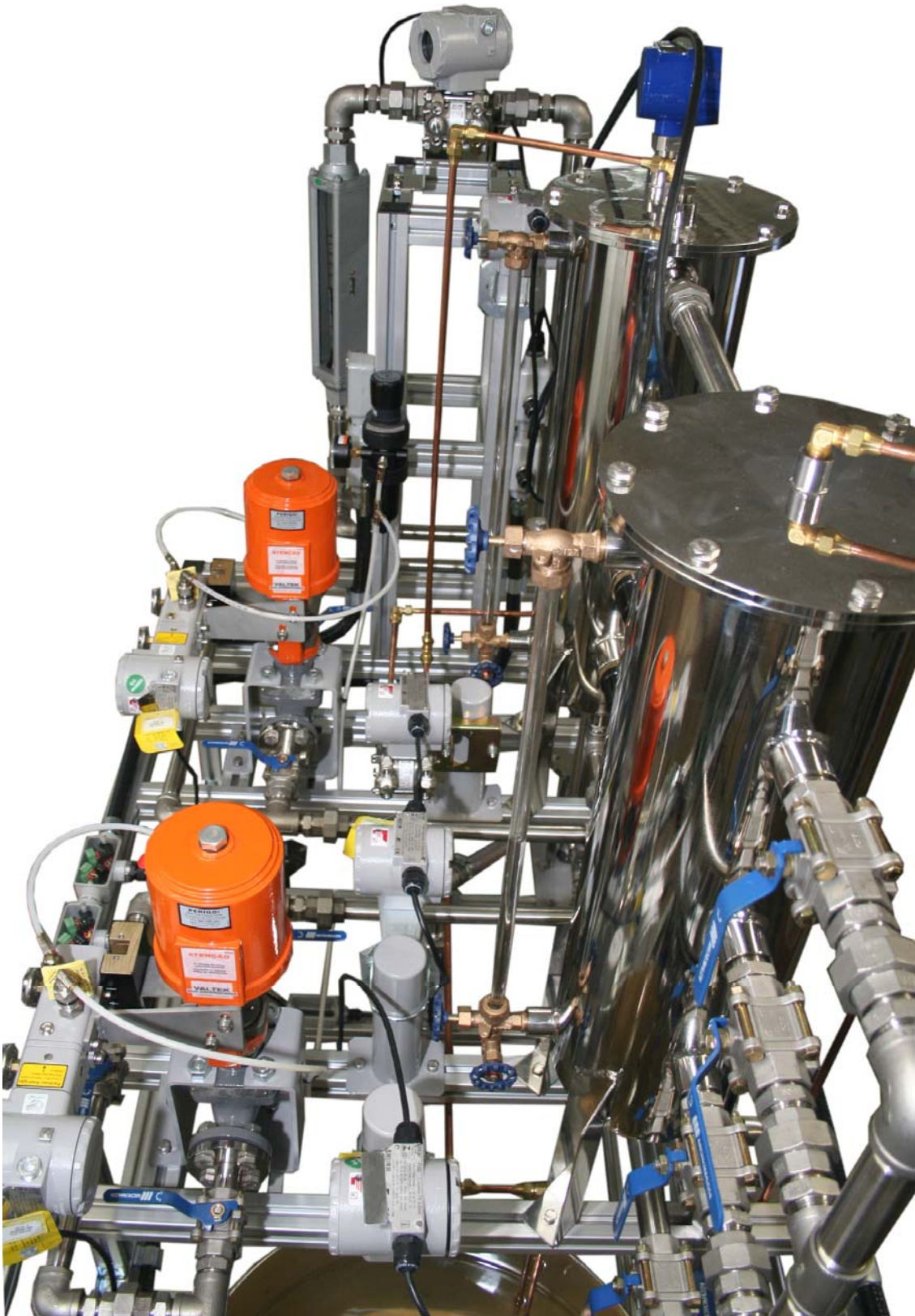
NOTE

The **PANEL** specification on Accessories and Spares List on this section shows specific details on each module that make up the Didactical Plant control panel on the **DFI302 manual**, the **DFI302 Digital and Analog Input/Output Modules** and other Smar equipment manuals available on the website: [HTTP://www.smar.com.br](http://www.smar.com.br).

Control Panel - back view



Upper view



Spare Parts and Accessories List

NOTE

To ensure the PD3-F guarantee, any spare or accessory on the list of items to be purchased by the client must be installed only by the Smar technical team.

SPARE PARTS AND ACCESSORIES LIST

	Qty.	DESCRIPTION	ORDER CODE	TAG	MAKER (NOTE 6)	POSITION (NOTE 8)
DEVICES (NOTE 1)	1	Pressure Transmitter Level Measurement Differential	LD302D-21I-BU11-02 . A1/D0/H0/I5/P0/S0/XX/J0	LIT-31	SMAR	1
	2	Pressure Transmitter Flow Measurement Differential	LD302D-21I-BU11-02 . A1/D0/H0/I5/P0/S0/XX/J0	FIT-31, FIT-32	SMAR	2
	1	PT-100 IEC Temperature Transmitter	TT302-12-0 . H0/I5/L3/XX/P0/S0/T4/J0/M0	TIT-31	SMAR	3
	1	J-NBS Thermopar Temperature Transmitter	TT302-12-0 . H0/I5/L2/XX/P0/S0/TC/J0/M0	TIT-32	SMAR	4
	2	Valve Positioner	FY302-11-058 . H0/I5/P0/S0/XX/J0/R0/K0	FY-31, FY-32	SMAR	5
	2	Positioner Bracket	BFY-VT-9II	-	SMAR	5
	1	Current Fieldbus Converter	FI302-12-0 . H0/I5/P0/S0/T0/XX/J0	UIC-31	SMAR	6
	2	Local Adjustment Magnetic Screwdriver	SD-1	-	SMAR	-
PANNEL	MODULE DF63 DARDWARE					7
	1	4-slot Rack – With Diagnostics	DF93	-	SMAR	-
	1	DFI Power Supply Module	DF50 . S0	-	SMAR	-
	1	DFI302 Module Two 10/100MBPS Processers, Four H1 Processers	DF63	-	SMAR	-
	1	Fieldbus Network Power Supply	DF52 . S0	-	SMAR	-
	1	4-Channel Foundation Fieldbus Line Filter	DF53 . S0	-	SMAR	-
	1	DFI terminator	DF2 . S0	-	SMAR	-
	MODULE DF75 HARDWARE					7
	1	4-slot rack with diagnostics	DF93	-	SMAR	-
	1	IMB Start Stabilizer	DF84	-	SMAR	-
	1	DFI Power Supply	DF50 . S0	-	SMAR	-
	1	Logic Processer	DF75	-	SMAR	-
	1	Two 8-group DFI Module	DF15 . S0	-	SMAR	-
	1	Two 8-group DFI Module – NA relay Outputs (Double insulation and RC Filter)	DF28 . S0	-	SMAR	-
	1	DFI Terminator	DF2 . S0	-	SMAR	-
	OTHER EQUIPMENT AND ACCESSORIES FOR INDUSTRIAL USE					7
	2	Twisted Pair 100, TX Base, DF interconnection > Switch Length: 0,5 m	DF54.S0	-	SMAR	-
	1	Twisted Pair 100, TX Base, interconnection switch > PC Length: 3 m	DF54.S0	-	SMAR	-
	1	Signal Distributor and Insulator	IS400P-00 . L0	-	SMAR	-
	1	5-door Ethernet Switch	SWITCH	-	(NOTE 7)	-
	1	Fieldbus Bus Terminator	BT302 . I5	-	SMAR	-
1	12-lamp Diode Matrix Interface for tests	ITF-D-12	-	SMAR	7.1	
SOFTWARE (NOTE 2)	1	Studio SYSTEM302 DVD	SYSTEM302 . AC/XX	-	SMAR	-
	1	SYSTEM302 and ProcessView License Package - System302 VXX - ProcessView VXX License Level: Execution system with counting for 500 I/O points	SYS302PCKP-3-5-1	-	SMAR	-

SPARE PARTS AND ACCESSORIES LIST							
	Qty.	DESCRIPTION	ORDER CODE	TAG	MAKER (NOTE 6)	POSITION (NOTE 8)	
	1	Hardkey for SYSTEM302 or ProcessView License Package - System302 VXX - ProcessView VXX <i>License Level: Execution system with counting for 500 I/O points</i>	HKS302PCKP-3-5-1	-	SMAR	-	
OTHER EQUIPMENT AND ACCESSORIES FOR INDUSTRIAL USE	1	PT-100 thermoresistance	RTD_STD-1S3CB-311A2CSZ2-00N2-I6-0000000 . C2	TE-31	(NOTE 7)	8	
	1	J NBS thermopar	TC_STD-3S2MP-311A1CSZ1-0IN2-I6-0000000 . C1	TE-32	(NOTE 7)	9	
	2	1" Integral Orifice	OIT21-N11T-I-0000-1	FE-31, FE-32	(NOTE 7)	10	
	2	Globe type Valve Control with Pneumatic Actuator	VALV_GLO (NOTE3)	-	(NOTE 7)	11	
	1	Conductive Level Switch	LC-350 AS203 Remota	-	(NOTE 7)	12	
	2	Electrode type Level Sensor	LE-01AABA019024100(15)	-	(NOTE 7)	13	
	1	Thermostat	T4 61 TS 040 XFS 20/95	-	(NOTE 7)	14	
	2	Rotameter	4T71205X12	-	(NOTE 7)	15	
	1	J NBS type Compensation Cable Thermopar – 1,5 m length	(NOTE 5)		(NOTE 7)	-	
	2	Pump with Motor	P500 (NOTE 3)	-	(NOTE 7)-	16	
	1	Static Converter	TH 8021A / 25-12	-	(NOTE 7)	17	
	2	2000 W Immersion Resistance	(NOTE 5)	-	(NOTE 7)	18	
	1	Metal Table	(NOTE 5)	-	(NOTE 7)	19	
	1	Heat Tank	(NOTE 5)	-	(NOTE 7)	20	
	1	Mixture Tank	(NOTE5)	-	(NOTE 7)	21	
	1	Water Supply Reservoir Tank	(NOTE 5)	-	(NOTE 7)	22	
	2	Breakless rotation	(NOTE 5)	-	(NOTE 7)	23	
	2	Break rotation	(NOTE 5)	-	(NOTE 7)	24	
	10	1" three-part sphere valve	(NOTE 5)	-	(NOTE 7)	25	
	12	3/4" three-part sphere valve	(NOTE 5)	-	(NOTE 7)	26	
	1	Piping, connections, screws and nuts	(NOTE 5)	-	(NOTE 7)	-	
	1	Brackets, flanges and accessories	(NOTE 5)	-	(NOTE 7)	-	
	KITS	1	Discrete I/O kit	(Optional Item) (NOTE 4)	-	SMAR	-
		1	Inverter kit	(Optional Item) (NOTE 4)	-	SMAR	-
		1	Closed pannel kit	(Optional Item) (NOTE 4)	-	SMAR	-

NOTES

- 1) XX – On the FOUNDATION™ fieldbus products code use always the firmware with the latest factory version. To update the devices firmware refer to the site, [HTTP://www.smar.com.br](http://www.smar.com.br).
- 2) XX – The software versions must always comply with the factory version.
- 3) The specification (description/reference) is defined by the client. Contact us and check all the available options.
- 4) Smar provides several didactical kits options. **This kit is not included in the standard Didactical Plant set supplied by Smar and is an optional item.** Contact us and check all the available options.
- 5) Contact us and check the availability of this item.
- 6) The specific Smar device manuals are available at our site: [HTTP://www.smar.com.br](http://www.smar.com.br)
- 7) Equipment acquired from third parties.
- 8) Position of Didactical Plant equipment on the figures and drawings in this section

Startup Assistance

Smar provides the following services of installation and startup checking:

- Electrical Mounting;
- Mechanical Mounting;
- Electrical Interconnection Projects;
- Mechanical Mounting Projects;
- Applications Configuration;
- Technical Assistance.

NOTE

The client has 90 (ninety) days from the Fiscal Note issuing date to request a Smar technician to verify the Didactical Plant installation and startup.
After this period, the customer must purchase this service separately responsible for all expenses.

Training

The manuals for software and hardware configuration, installation and maintenance included on the Smar Didactical Plant, combined with the training programs offered by Smar, give instructors full autonomy and conditions to alter and improve the system.

The Smar Training Center provides specialized courses covering both aspects on the project initial stage and on the operation, supervision and maintenance of processes and control loops, which may be adjusted to the specific needs of your team.

The courses and training may be given on-site in colleges and schools, in companies, or in the Smar Training Center located in the city of Sertãozinho, São Paulo state.

For more details refer to [HTTP://www.smar.com/brasil2/treinamento](http://www.smar.com/brasil2/treinamento)

Section 5

TECHNICAL FEATURES

Functional Specifications

Input Signal	Only Digital, Fieldbus, voltage mode 31.25 Kbit/s with bus power supply
Power Supply Requirements	Electrical power supply: 220 Vca, 60 Hz; Consumption: 5,5 KW; Air supply: 4-7 bar; Consumption: 100 NI/min (3.5 SCFM) for power supply pressure of 5.6 bar (80 psi); Water input connection; Air input connection; Water supply draining input .
Configuration	Through Smar SYSTEM302 Industrial Automation System.

NOTE

PD3-F water supply must be done with clean water only.
PD3F air supply must be done with instrument air only.
Refer to Section 1 on this manual for further details on water and air supply.

Physical Specifications

Construction Material	Aluminum structure; Stainless Steel 304 tanks and piping.	
Equipment Dimensions	Mounting: 2300 mm width x 1000 mm depth x 2100 mm height.	
Equipment weight	Approximate weight, without water on tanks and packaged:	800 kg.
	Approximately weight after installed, without packaging (80 to 100 kg) and with full water tank (120 liters maximum):	820 a 850 kg.

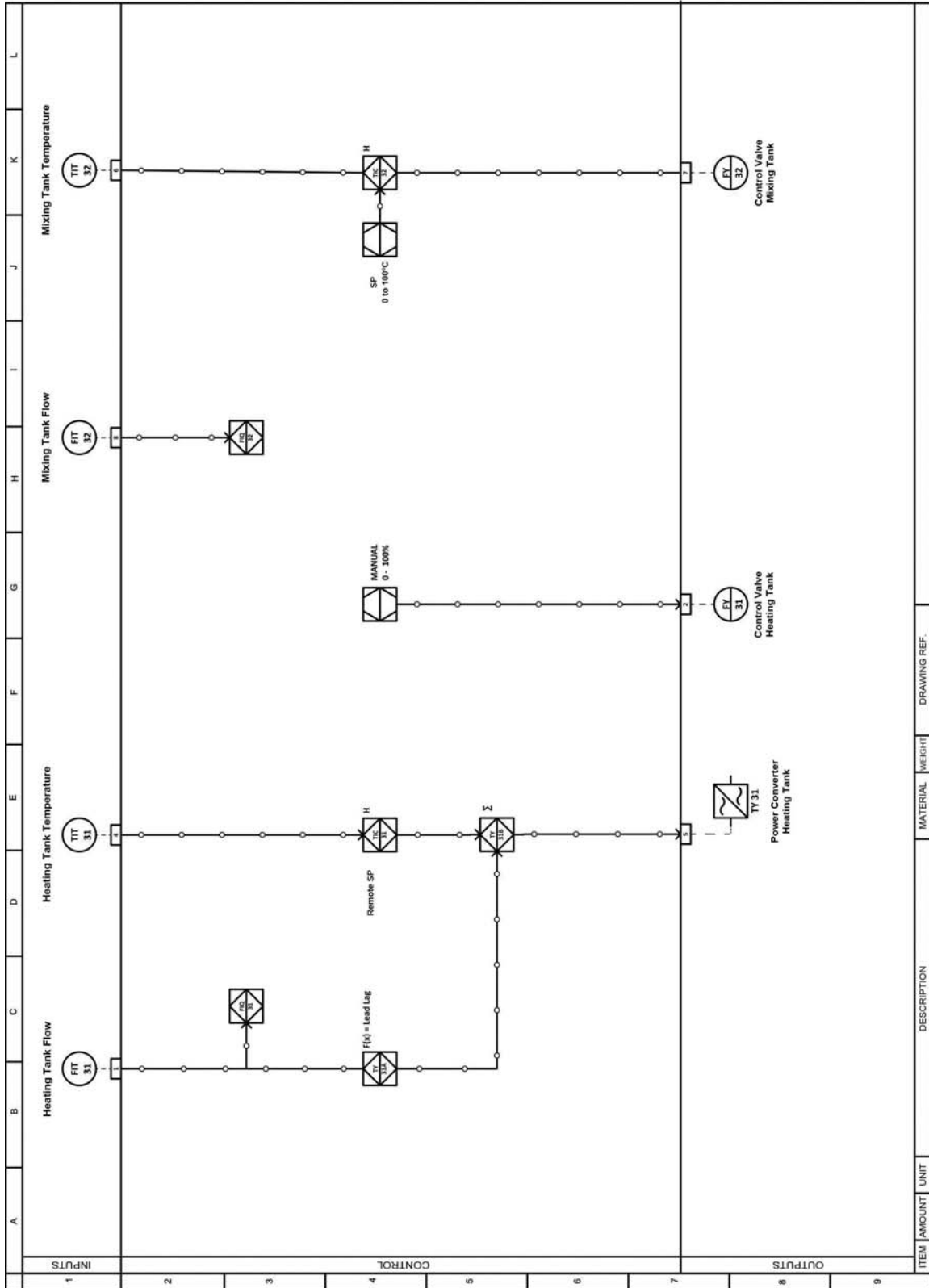
Order Code

MODEL	DIDACTICAL PLANT
PD3-F	FOUNDATION™ fieldbus;

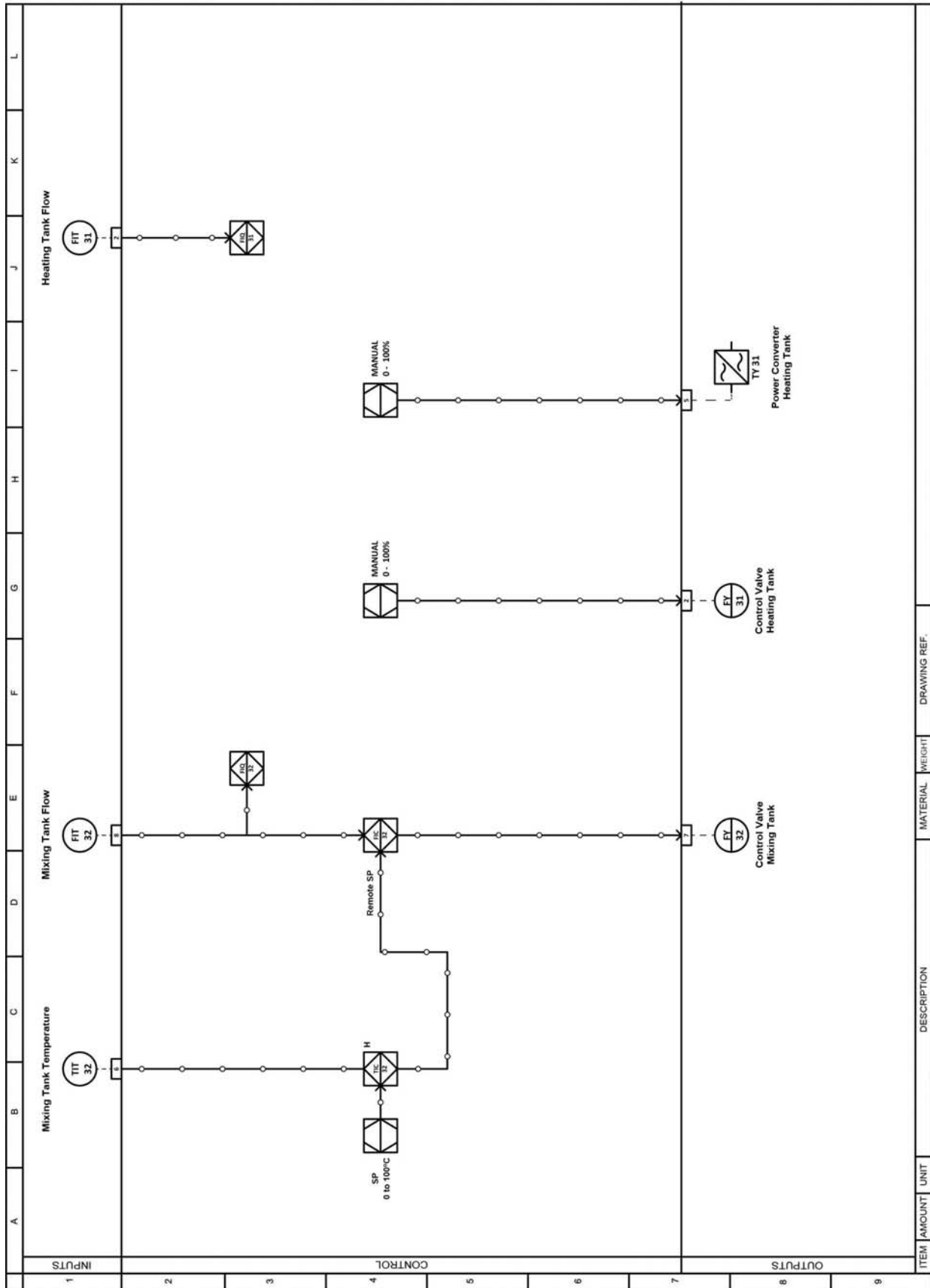
Appendix A

APPLICATIONS

Feed Forward Control



Cascade Control



SMAR WARRANTY CERTIFICATE

1. SMAR guarantees the equipment of its own manufacture for a period of 24 (twenty four) months, starting on the day the invoice is issued. The guarantee is effective regardless of the day the product was installed. Third-party equipment and software are not included in this Term of Guarantee and Smar does not offer any guarantee or declaration in the name of the manufacturer. Any guarantees related to these products are the supplier or licensor responsibility.
2. SMAR products are guaranteed against any defect originating from manufacturing, mounting, whether of a material or manpower nature, provided that the technical analysis reveals the existence of a quality failure liable to be classified under the meaning of the word, duly verified by the technical team within the warranty terms.
3. Exceptions are proven cases of inappropriate use, wrong handling or lack of basic maintenance compliant to the equipment manual provisions. SMAR does not guarantee any defect or damage caused by an uncontrolled situation, including but not limited to negligence, user imprudence or negligence, natural forces, wars or civil unrest, accidents, inadequate transportation or packaging due to the user's responsibility, defects caused by fire, theft or stray shipment, improper electric voltage or power source connection, electric surges, violations, modifications not described on the instructions manual, and/or if the serial number was altered or removed, substitution of parts, adjustments or repairs carried out by non-authorized personnel; inappropriate product use and/or application that cause corrosion, risks or deformation on the product, damages on parts or components, inadequate cleaning with incompatible chemical products, solvent and abrasive products incompatible with construction materials, chemical or electrolytic influences, parts and components susceptible to decay from regular use, use of equipment beyond operational limits (temperature, humidity, etc.) according to the instructions manual. In addition, this Warranty Certificate excludes expenses with transportation, freight, insurance, all of which are the customer's responsibility.
4. For warranty or non-warranty repair, please contact your representative.

Further information about address and contacts can be found on www.smar.com/contactus.asp
5. In cases needing technical assistance at the customer's facilities during the warranty period, the hours effectively worked will not be billed, although SMAR shall be reimbursed from the service technician's transportation, meals and lodging expenses, as well dismounting/mounting costs, if any.
6. The repair and/or substitution of defective parts do not extend, under any circumstance, the original warranty term, unless this extension is granted and communicated in writing by SMAR.
7. No Collaborator, Representative or any third party has the right, on SMAR's behalf, to grant warranty or assume some responsibility for SMAR products. If any warranty would be granted or assumed without SMAR's written consent, it will be declared void beforehand.
8. Cases of Extended Warranty acquisition must be negotiated with and documented by SMAR.
9. If necessary to return the equipment or product for repair or analysis, contact us.
See item 4.
10. In cases of repair or analysis, the customer must fill out the Revision Requisition Form (FSR) included in the instructions manual, which contains details on the failure observed on the field, the circumstances it occurred, in addition to information on the installation site and process conditions. Equipments and products excluded from the warranty clauses must be approved by the client prior to the service execution.
11. In cases of repairs, the client shall be responsible for the proper product packaging and SMAR will not cover any damage occurred in shipment.
12. In cases of repairs under warranty, recall or outside warranty, the client is responsible for the correct packaging and packing and SMAR shall not cover any damage caused during transportation. Service expenses or any costs related to installing and uninstalling the product are the client's sole responsibility and SMAR does not assume any accountability before the buyer.

13. It is the customer's responsibility to clean and decontaminate products and accessories prior to shipping them for repair, and SMAR and its dealer reserve themselves the right to refuse the service in cases not compliant to those conditions. It is the customer's responsibility to tell SMAR and its dealer when the product was utilized in applications that contaminate the equipment with harmful products during its handling and repair. Any other damages, consequences, indemnity claims, expenses and other costs caused by the lack of decontamination will be attributed to the client. Kindly, fill out the Declaration of Decontamination prior to shipping products to SMAR or its dealers, which can be accessed at www.smar.com/doc/declarationofcontamination.pdf and include in the packaging.
14. This warranty certificate is valid only when accompanying the purchase invoice.

Returning Materials

Should it become necessary to return the equipment to SMAR, simply contact our office, informing the defective instrument serial number, and return it to our factory.

In order to speed up analysis and solution of the problem, the defective item should be returned with a description of the failure observed, with as much details as possible. Other information concerning the instrument operation, such as service and process conditions, is also helpful.

Instruments returned or to be revised outside the guarantee term should be accompanied by a purchase order or a quote request.

The shipping charges and return are the sole responsibility of the customer.