Pressure, Flow, Level, and Temperature Process Learning Systems
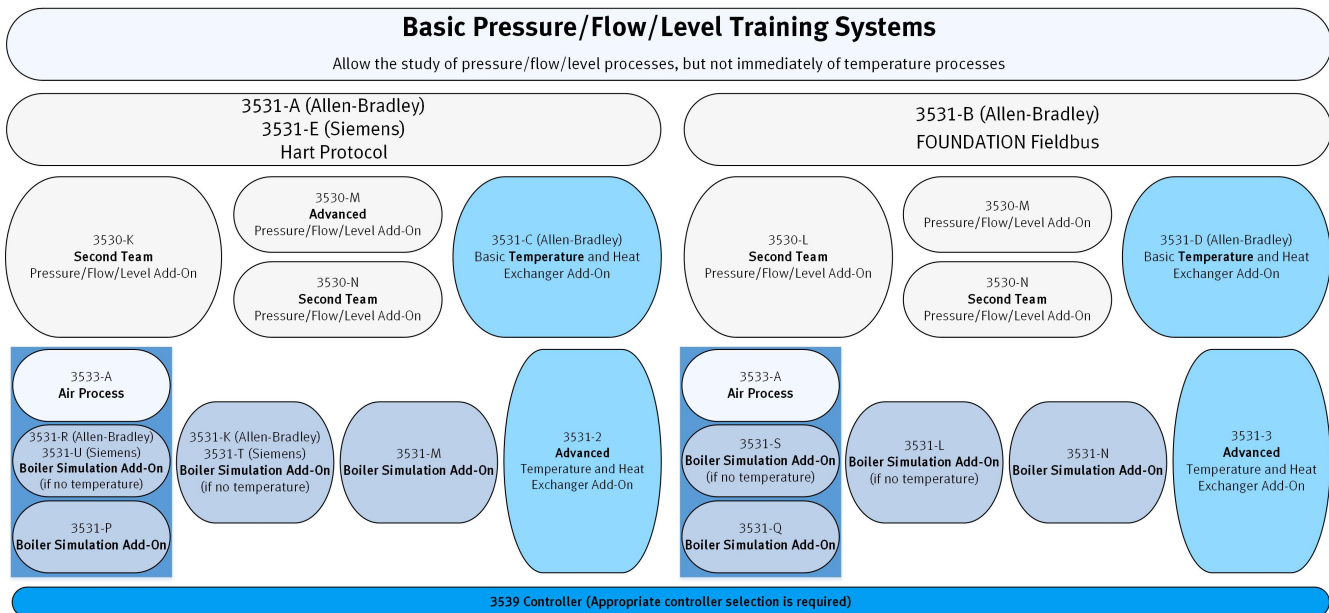## 3531

FESTO
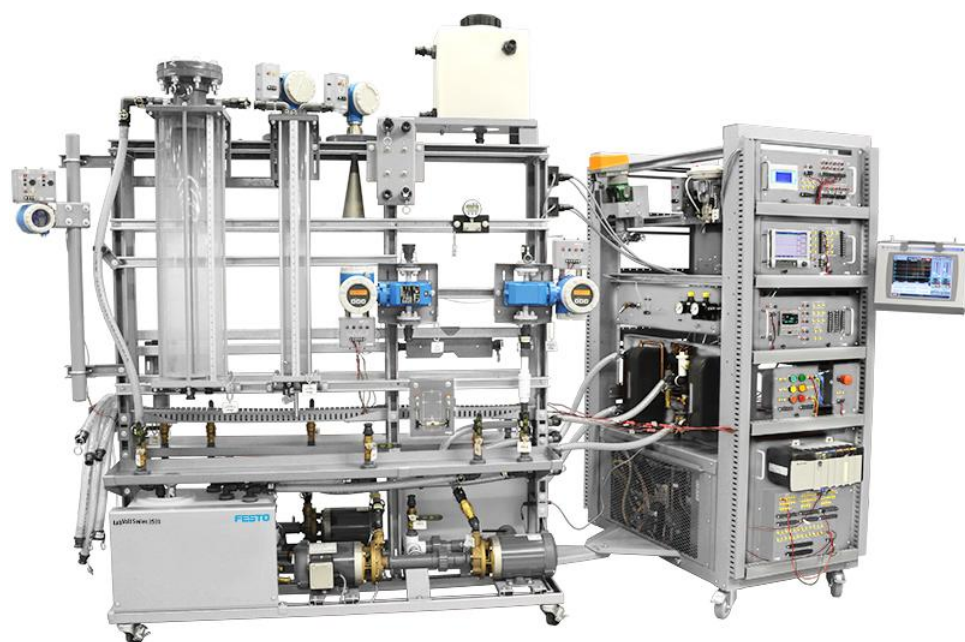
Table of Contents

General Description

The Pressure, Flow, Level, and Temperature Process Learning Systems introduce students to a wide range of industrial processes, as well as to their instruments and control devices. The training systems are part of the Instrumentation and Process Control program, which uses modern equipment and a complete curriculum to help students assimilate the theoretical and practical knowledge that is mandatory to work in the process control industry.

The modularity of these energy-efficient process control Learning Systems allows the instructor to select specific equipment as a function of the training objectives without going over budget. Several configurations are available for a single workstation. Adding optional equipment can increase the number of these configurations.

The Pressure, Flow, Level, and Temperature Process Learning Systems feature two workstations: the Process Workstation and the Instrumentation Workstation. The workstations can accommodate a single team of students for the temperature experiments and up to two teams for the pressure, flow, and level experiments if the second-team add-on is used.

The system also features training on complex control loop strategies such as the ones used for controlling a level in a boiler. For the boiler simulation, the students will need to apply different advanced control strategies such as split-range, ratio and feed-forward covered during the learning path adapted according to their specific needs.

Structure of the Pressure, Flow, Level, and Temperature Process Learning Systems (Scenario 1)

Basic Temperature and Heat Exchanger Training Systems
Allow the study of temperature processes and other optional processes

3531-0 (Allen-Bradley) HART Protocol	**3531-1 (Allen-Bradley)** FOUNDATION Fieldbus

3531-2
Advanced
Temperature and Heat Exchanger
Add-On

3530-F
Pressure/Flow/Level Add-On

3531-3
Advanced
Temperature and Heat Exchanger
Add-On

3530-G
Pressure/Flow/Level Add-On

3530-H
Second Team
Pressure/Flow/Level Add-On

3530-M
Advanced
Pressure/Flow/Level Add-On

3530-N
Second Team
Pressure/Flow/Level Add-On

3530-J
Second Team
Pressure/Flow/Level Add-On

3530-M
Advanced
Pressure/Flow/Level Add-On

3530-N
Second Team
Pressure/Flow/Level Add-On

3533-A
Air Process

3531-P
Boiler Simulation Add-On

3531-M
Boiler Simulation Add-On

3533-A
Air Process

3531-Q
Boiler Simulation Add-On

3531-N
Boiler Simulation Add-On

3539 Controller (Appropriate controller selection is required)

Structure of the Pressure, Flow, Level, and Temperature Process Learning Systems (Scenario 2)

Process Workstation

The Process Workstation is the hub of the different processes to be investigated by the students. It consists of a double-sided mobile workstation equipped with two 60 L (16 gal) tanks, up to four centrifugal pumps, a Rotameter, a Drip Tray (Front), an Instrumentation Mounting Pipe, Ball Valves, and Process Supports.

Up to two groups of students can work at the same time on Pressure/Flow/Level experiments, one group on each side of the Process Workstation. This can be done if the Pressure/Flow/Level option is selected and if the Second Team Add-on, Model 3530-H or -K (HART) is ordered (3530-J or - L for FOUNDATION Fieldbus).

To configure the system for hands-on training, students have to install the appropriate instruments as described in the student manuals. The student manuals cover both the theory and practice of measurement, control, and troubleshooting of temperature, pressure, flow, and level processes.

Instrumentation Workstation

The Instrumentation Workstation is designed to house the Electrical Unit and the Pneumatic Unit as well as other electrical equipment such as the variable speed drives. Devices such as controllers, PLCs, Color Paperless Recorder, and Touch Screen Graphic Terminals must be installed on the Instrumentation Workstation. The workstation aims to recreate the widespread industrial practice of separating the process environment from the instruments and controllers and it limits the risk of exposing such equipment to contact with water.

The Electrical Unit provides power for the instruments used in the Pressure, Flow, Level, and Temperature Process Learning Systems. It includes a lockable power switch and a 24 V dc power supply. The design of the Electrical Unit allows cutoff of both the electric and pneumatic power using either an emergency button or the lockable power switch. The teaching material includes a complete lockout/tagout procedure explaining how to lock the power switch. This procedure is similar to the procedure used in industry to lock and unlock electrical equipment.

Like the Process Workstation, the Instrumentation Workstation is a double-sided mobile workstation. Two groups of students can work at the same time on the system, one group on each side.

The Instrumentation Workstation also features a retractable shelf.

The dimensions of the Instrumentation Workstation (excluding any device installed on it) are: 680 x 1180 x 1890 mm (26.8 x 46.5 x 74.4 in).

Instrumentation Workstation shown with optional equipment.

Hitch Mechanism

A hitch mechanism used to link the Instrumentation Workstation to the Process Workstation is part of the Piping and Accessories kit (Model 46993-C). This convenient piece of equipment makes it possible to move both stations as a single unit. The hitch mechanism must be installed and used as shown in the picture below.

Hitch mechanism for the workstations of the 3531 system

Temperature Process System

This system is designed to feature the equipment required to complete the measurement, control, and troubleshooting exercises for temperature processes. It includes a Heating/Cooling Unit, a Brazed Plate Heat Exchanger, a three-way control valve, a thermocouple, an RTD (Resistance Temperature Detector), and a temperature transmitter. The temperature transmitter can support either the HART or the FOUNDATION Fieldbus communication protocols.

A variety of optional heat exchangers is available for advanced training in temperature process control:

- a Gasketed Plate Heat Exchanger
- a Shell and Tube Heat Exchanger (1 pass)
- a Shell and Tube Heat Exchanger (4 pass)

Pressure, Flow, and Level Process System

This system includes the equipment required to complete the measurement, control, and troubleshooting exercises for the pressure, flow, and level processes.

This system features two differential-pressure transmitters supporting the HART communication protocol, a digital pressure gauge, a pneumatic control valve, a color paperless recorder, a rotameter, and a Venturi tube. Transmitters supporting other communication protocols such as FOUNDATION Fieldbus are available on request.

A wide variety of optional equipment is available for advanced training in pressure, flow, and level process control:

- a Column (Small Diameter)
- an Orifice Plate
- a Pitot Tube
- an Electromagnetic Flow Transmitter (HART)
- a Vortex Flow Transmitter (HART)
- a Coriolis Flow Transmitter (HART)
- a Paddle Wheel Flow Transmitter
- an Ultrasonic Level Transmitter (HART)
- an Ultrasonic Flow Transmitter (HART)
- a Radar Level Transmitter (HART)
- a Guided-Radar Level Transmitter (HART)
- a Vibrating Fork Level Switch
- a Conductivity Level Switch
- a Capacitive Level Transmitter (HART)
- a Float Switch
- a Pressure Switch (with Analog Output)
- a Pressure Transmitter (HART)

Most models are also available in a FOUNDATION Fieldbus-compliant version. Consult the descriptions for details.

Optional Valves

A selection of pneumatic control valves are available to upgrade the training system. The valves are provided with a current-to-pressure converter (if required). Among the valves available are:

- Pneumatic Control Valves with different Digital Positioners (Three-Way Valve versions also available)
- a Pneumatic Control Valve with Positioner (Three-Way Valve version also available)
- Electric Control Valve (Three-Way Valve version also available)
- a Solenoid Valve
- a Ball Valve

Controllers

A wide selection of controllers is available, such as:

- Industrial PID Controllers (Ethernet or Modbus)
- Programmable Logic Controllers (with Ethernet communications, Analog I/O, programming software, and Communication Cable)

SCADA / DCS Software

Two SCADA software programs are available for the system: Wonderware Development Studio (including InTouch) and FactoryTalk View Studio (from Rockwell Software). Both software programs come with an interface specially designed for the Pressure, Flow, Level, and Temperature Process Training Systems. An OPC server for the Foxboro controller is also available.

Calibration Instrumentation

An accurate calibration device is an essential addition to the system. It allows calibration and maintenance of the transmitters, current to pressure converter, gauges, and control valves. Four different calibration packages are available. A basic version makes it possible to perform the required calibration and a second version includes more advanced equipment.

Three other calibration kits are each designed to act as configurator and sophisticated tools to calibrate the smart devices over the HART and/or the FOUNDATION Fieldbus communication protocols.

Other devices

Other devices are also available to enhance the system. These devices allow the students to explore more technologies and communication protocols used in the industry. Among the optional devices available are:

- a Signal Tower
- Touch Screen Graphic Terminal (available in two sizes)
- an additional Pumping Unit

Smart devices: HART® and FOUNDATION™ Fieldbus

Many components of the Pressure, Flow, Level, and Temperature Process Learning Systems feature a transmitter which is able to communicate via one of two communication protocols: HART or FOUNDATION Fieldbus.

The HART protocol enables communication between devices by superimposing digital signals on top of the existing 4-20 mA outputs. The Fieldbus protocol is like a Local Area Network (LAN) for smart devices.

Most of these devices can usually be configured manually via their alphanumeric display and/or push-buttons, but it is much quicker and more efficient to use a communication link to configure them remotely from a computer. The HART apparatuses can be connected to a computer using the HART Software Configurator (Model 46982-0 or -B). Fieldbus devices can be configured from a computer with the FOUNDATION Fieldbus Software Configurator (Model 46982-A or -B). Calibration kits are available for each of the two communication protocols.

A Software Configurator compatible with the selected communication protocol is strongly suggested and is even mandatory for some specific transmitters.

Troubleshooting

Troubleshooting of industrial process equipment is an integral part of the learning process. This is why the Pressure, Flow, Level, and Temperature Process Learning Systems features many tools to help instructors devise troubleshooting exercises for the students. Faults can be inserted in most devices: Controllers, PLCs, Valves, Transmitters, etc.

There are three different methods to insert faults:

- Local fault insertion is done by accessing the fault panel on a particular device to activate faults as required.
- Remote calibration fault insertion is performed by changing the calibration parameters of a device from the instructor's computer over either the HART or the FOUNDATION Fieldbus communication protocol (requires the appropriate modules).
- Remote fault insertion is achieved by remotely modifying the state of I/O relays on a PLC from a computer or from a touch screen terminal.

Pressure and Flow – Compressed Air

A training system covering the principles of compressed air is available as an add-on to the Pressure, Flow, Level, and Temperature Process Learning Systems. Measurement and control experiments related to pressure and flow of compressed air are performed using the following devices:

- Air tanks
- Air rotameter
- Orifice plate for air
- Solenoid valve for air
- Pneumatic control valve for air

Boiler Simulation (Water / Air)

The Boiler Simulation system is an inherently safe boiler simulator which is not pressurized and works with water at room temperature. The key features of a boiling process are replicated with a controlled flow of air injected at the base of a process column containing a controllable level of water. Up to three elements and three control loops (2 PID loops and 1 calibrator) are involved in the control of the level of water in the drum of the boiler.

The boiling process is recreated by regulating the flow of air injected in the column while operating a second pump which drains the column to simulate evaporation of water. The Boiler Simulation system is a synthesis of many industrial control notions and involves multiple control loops as well as feedforward and cascade control.

The Boiler Simulation is an add-on to the Pressure, Flow, Level, and Temperature Process Training Systems and may include a pump and a drive if required. The boiler system can only be used by one team at a time. A controller with a minimum of three inputs and two PID loops capable of both cascade and feedforward control and a 4-20 mA calibrator are also necessary.

As both cascade and feedforward control schemes are used, the Advanced Pressure, Flow, Level Add-On, Model 3530-M, is required and it is assumed that the students are familiar with these topics beforehand.

Simulation of boiling water in the Process Column.

Advanced Process Control - Temperature

The inclusion of this add-on (Model 3531-2 or -3) to the Process Control Learning system offers the possibility to perform a set of advanced temperature control experiments. The main feature resides in the use of electromagnetic flowmeters and RTDs coupled to the energy manager to obtain precise energy balances.

Advanced Pressure, Flow, Level Process Add-On

The Advanced Pressure, Flow, Level Process Add-On, Model 3530-M, is an add-on that offers the capability to perform a set of advanced process control experiments. The experiments include feedforward control, ratio control, split-range control, and the control of second-order processes. The add-on includes a small-diameter column, an upper tank, an orifice plate, a pneumatic control valve, and some accessories.

Optional System Add-Ons

The Pressure, Flow, Level, and Temperature Process Learning Systems can also be equipped with optional add-ons such as:

- pH and conductivity add-ons. To obtain information on the capabilities and models available, please refer to the companion datasheet for the 3532 system (88164).

Air Requirements

The Pressure, Flow, Level, and Temperature Process Learning Systems require a reliable source of compressed air from a central air supply or portable unit able to deliver air at a minimal flow of 110 L/min (4 CFM), with a pressure of 620 kPa (90 PSI).

Compressed air units are also available. The Air Compressor, Model 6410-B, is a silent portable unit able to supply air to a single station and is well suited to the systems.

Standard Learning Path
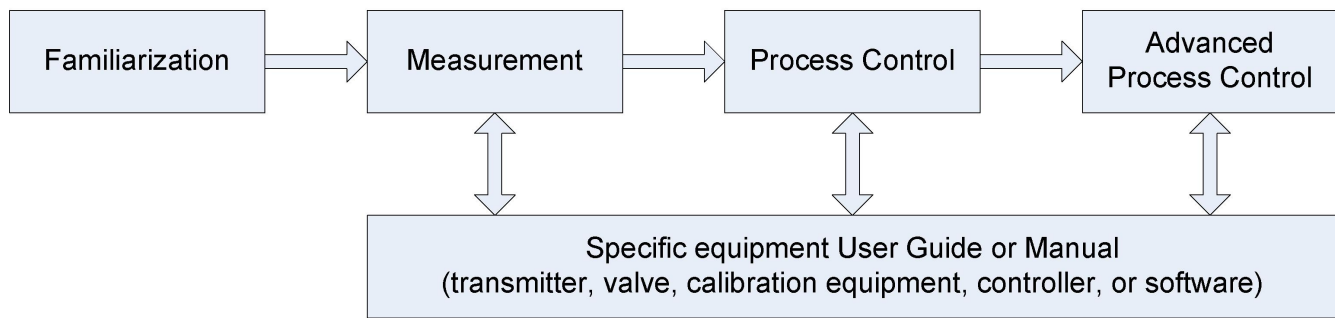
Content dependency structure of the curriculum for the 3531 system

3531 - Pressure, Flow, Level, and Temperature Training Systems

		HART		FOUNDATION Fieldbus	
	Device	**First team**	**Second team**	**First team**	**Second team**
Basic system water process	Pressure, flow, level (Allen-Bradley)	3531-A[1]	3530-K	3531-B[1]	3530-L
	Pressure, flow, level (Siemens)	3531-E	3530-K		
System add-on (water)	Pressure, flow, level add-on - advanced	3530-M	3530-N	3530-M	3530-N
System add-on (water)	Temperature add-on - basic	3531-C[1]	-	3531-D[1]	-
System add-on (water)	Temperature add-on - advanced	3531-2	-	3531-3	-
System add-on (air)	Pressure, flow add-on	3533-A	-	3533-A	-
Boiler system (water, air)	Boiler simulator add-on	3531-M[2] (w/o 3533-A, w/ 3531-C) 3531-P[2] (w/ 3533-A, w/ 3531-C)		3531-N[2] (w/o 3533-A, w/ 3531-D) 3531-Q[2] (w/ 3533-A, w/ 3531-D)	
	Boiler simulator add-on (Allen-Bradley)	3531-K[2] (w/o 3533-A, w/o 3531-C) 3531-R[2] (w/ 3533-A, w/o 3531-C)		3531-L[2] (w/o 3533-A, w/o 3531-D) 3531-S[2] (w/ 3533-A, w/o 3531-D)	
	Boiler simulator add-on (Siemens)	3531-U[2] (w/ 3533-A, w/o 3531-C) 3531-T[2] (w/o 3533-A, w/o 3531-C)		-	

[1] : This model is tension sensitive. Standard (single-phase) and three-phase versions are available.

[2] : This add-on to the basic system requires a total of three PID loops.

Scenario 1: the pressure, flow, level processes option is selected and the other ones are considered.

	Device	HART		FOUNDATION Fieldbus	
		First team	Second team	First team	Second team
Basic system	Temperature (Allen-Bradley)	3531-0[1]	-	3531-1[1]	-
System add-on (water)	Temperature add-on - advanced	3531-2	-	3531-3	-
System add-on (water)	Pressure, flow, level add-on - basic	3530-F	3530-H	3530-G	3530-J
System add-on (water)	Pressure, flow, level add-on - advanced	3530-M	3530-N	3530-M	3530-N
System add-on (air)	Pressure, flow add-on	3533-A	-	3533-A	-
Boiler system (water, air)	Boiler simulator add-on	3531-M[2] (w/o 3533-A) 3531-P[2] (w/ 3533-A)		3531-N[2] (w/o 3533-A) 3531-Q[2] (w/ 3533-A)	

[1] : This model is tension sensitive. Standard (single-phase) and three-phase versions are available.

[2] : This add-on to the basic system requires a total of three PID loops.

Scenario 2: the temperature process option is selected and the other ones are considered.

Continuation of the Table for Scenarios 1 and 2

			HART		FOUNDATION Fieldbus	
		Device	First team	Second team	First team	Second team
Controllers	PID	Foxboro 762 Controller	3539-0	3539-0	-	-
		Honeywell Controller	3539-1	3539-1	-	-
	PLC	ControlLogix PLC (HART)	3539-5	3539-5[3]	3539-5[4]	3539-5[3]
		MicroLogix PLC	3539-7	3539-7	-	-
		CompactLogix PLC	3539-8	3539-8[3]	3539-8[4]	3539-8[3]
		FOUNDATION Fieldbus PLC Add-On	-	-	3539-9[4,5]	
		S7-1500 PLC Bundle HART – Educational	3539-P	3539-P[3]		
		S7-1500 PLC Bundle – Educational	3539-S	3539-S[3]		

		HART		FOUNDATION Fieldbus	
Configurators	HART Software Configurator	46982-0	46982-0	-	-
	FOUNDATION Fieldbus Software Configurator	-	-	46982-A	46982-A
	HART & FOUNDATION Fieldbus Software Configurator	46982-B	46982-B	46982-B	46982-B

[3] : A single controller of this type is sufficient for two teams working on the same workstation. A second license of RSLogix 5000 is required for simultaneous use by two teams.

[4] : The ControlLogix and CompactLogix PLCs can be used with the FOUNDATION Fieldbus communication protocol if a FOUNDATION Fieldbus PLC Add-on, Model 3539-9, is used.

[5] : A single 3539-9 can accommodate two teams.

		HART		FOUNDATION Fieldbus	
Transmitters and primary flow elements	Device	First team	Second team	First team	Second team
Pressure	Digital pressure gauge (low range)	46761-C		46761-C	
	Pressure switch with analog output	46926-0		46926-0	
	Pressure transmitter	46928-0		46928-A	
Flow	Orifice plate	46912-0		46912-0	
	Pitot tube	46913-0		46913-0	
	Electromagnetic flow transmitter	46922-0		46922-A	
	Vortex flow transmitter	46923-0		46923-A	
	Coriolis flow transmitter	46924-0		46924-A	
	Paddle wheel flow transmitter	46925-0		46925-0	
	Ultrasonic flow transmitter	46927-0		46927-A	
Level	Ultrasonic level transmitter	46930-0		46930-A	
	Radar level transmitter	46931-0		46931-A	
	Guided-radar level transmitter	46932-0		46932-A	
	Vibrating fork level switch	46933-0		46933-0	
	Conductivity level switch	46934-0		46934-0	
	Float switch	46935-0		46935-0	
	Capacitive level transmitter (HART only)	46936-0		-	

Valves	Device	HART		FOUNDATION Fieldbus	
		First team	Second team	First team	Second team
Pressure, flow, level	Pneumatic control valve with digital positioner – DVC 2000 (HART only)	46950-0		-	
	Pneumatic control valve with positioner	46950-A		46950-A	
	Electric control valve	46950-C		46950-C	
	Pneumatic control valve with digital positioner – DVC 6000	46950-E		46950-D	
	Ball valve	46952-0		46952-0	
	Pneumatic control vee-ball valve with digital positioner	46954-0		46954-A	
Temperature	Pneumatic three-way control valve with digital positioner – DVC 2000 (HART only)	46955-0		-	
	Pneumatic three-way control valve with positioner	46955-A		46955-A	
	Electric three-way control valve	46955-C		46955-C	
	Electric three-way control valve with digital positioner – DVC 6000	46955-E		46955-D	
Air	Pneumatic control valve with DVC 2000	46953-A		-	
	Pneumatic control valve with Fisher 3660 positioner	46953-B		46953-B	
	Pneumatic control valve with DVC 6000	46953-C		46953-C	

	Device	HART		FOUNDATION Fieldbus	
		First team	Second team	First team	Second team
Calibration[6]	Calibration kit	46980-0		46980-0	
	Calibration kit with pressure modules	46980-A		46980-A	
	Calibration kit (HART)	46981-0		-	
	Calibration kit (HART and FOUNDATION Fieldbus)	46981-1		46981-1	
SCADA / DCS	FactoryTalk View ME	46968-0		46968-0	
	Wonderware InTouch	46969-0		-	
	WinCC Advanced Development Software	46984-0		-	
	Touch-Screen Computer Mount	3451-B		3451-B	
	Touch screen graphic terminal – 14.5 cm (5.7 in) (requires a PLC) (Allen-Bradley)	5922-B		5922-B	
	Signal tower	5924-C		5924-C	
	Indicator lights / Push-button station	5925-A		5925-A	
	Fuzzy Logic software (requires RSLogix 5000)	5938-0		5938-0	
	Acoustic alarm	39303-0		39303-0	
	Touch-Screen Computer	46299-0		46299-0	

Topic Coverage

- Temperature
- Pressure, Flow, and Level
- Air Pressure and Flow
- pH and Conductivity
- Estimated program duration: 84 hours

Features & Benefits

- Modular system that allows a wide variety of configurations
- Two-sided workstation that enables two student groups to work simultaneously
- Faults can be inserted by the instructor to develop the troubleshooting skills of the students
- Extensive and comprehensive curriculum
- Entry level, cost-effective solution
- Industrial-grade components, clear PVC piping
- Real-world, large-scale process loops implemented in a space-efficient work environment
- Different controller options depending on the objectives and budget
- Smart transmitters and control valves implemented using HART or FOUNDATION Fieldbus communication protocols
- Ethernet and Modbus communication protocols also used with variable frequency drives and controllers
- Environment-friendly temperature training system (no cooling water required)
- Fast response temperature control system
- Advanced process control strategies such as ratio, feed-forward, and split-range
- Boiler simulation with three-element process control
- Real-time heat exchanger energy balance

List of Available Training Systems

Qty	Description	Model number
1	Pressure, Flow, Level Process Add-On – HART	588481 (3530-F0)
1	Pressure, Flow, Level Process, Second Team Add-On – HART	588485 (3530-H0)
1	Pressure, Flow, Level, Second team add-on	588488 (3530-K0)
1	Advanced Pressure, Flow, Level Process Add-On	588490 (3530-M0)
1	Temperature Process Training System (Allen-Bradley) – HART	582455 (3531-00)
1	Advanced Temperature Process Add-on – HART	582461 (3531-20)
1	Pressure/Flow/Level Process Training System (Allen-Bradley) – HART	582464 (3531-A0)
1	Temperature Process Add-On (Allen-Bradley) – HART	582470 (3531-C0)
1	Pressure/Flow/Level Process Training System (Siemens) – HART	589668 (3531-E0)
1	Boiler Simulation (Water/Air) Add-On (Allen-Bradley, Without Temperature Process) – HART	582474 (3531-K0)
1	Boiler Simulation (Water/Air) Add-On – HART (needs the Temperature, and Advanced pressure, flow, level)	582478 (3531-M0)
1	Boiler Simulation (Water/Air) Add-On - Siemens - HART (needs the Advanced pressure, flow, level)	589883 (3531-T0)
1	Boiler Simulation (Water/Air) Add-On - Siemens - HART (needs the Air Process, and the Advanced Pressure, Flow, Level)	589884 (3531-U0)
1	Air Pressure/Flow Process Add-On	588507 (3533-A0)

Qty	Description	Model number
1	ControlLogix PLC Bundle – Educational	588519 (3539-50)
1	MicroLogix PLC Bundle – Educational	588521 (3539-70)
1	CompactLogix PLC Bundle – Educational	588522 (3539-80)
1	MicroLogix PLC Bundle – Commercial	588514 (3539-C0)
1	CompactLogix PLC Bundle – Commercial	588515 (3539-D0)
1	S7-1500 PLC Bundle HART – Educational	589669 (3539-P0)
1	S7-1500 PLC Bundle – Educational	589670 (3539-S0)
1	I/O Interface with LVProSim	763509 (9065-B0)

Available Training Systems

Pressure, Flow, Level Process Add-On – HART
588481 (3530-F0)

The Pressure, Flow, Level Process Add-On – HART is an add-on to the Pressure, Flow, Level, and Temperature Training System, Model 3531. The add-on comprises two differential pressure transmitters supporting the HART$^®$ communication protocol.

The add-on includes all the equipment required to complete the measurement, control, and troubleshooting exercises for the pressure, flow, and level processes. Transmitters supporting other communication protocols such as FOUNDATION Fieldbus are available on request.

List of Equipment

Qty	Description	Model number
1	Familiarization with the Training System - Pressure, Flow, and Level	8089746 (80897-46)
1	Measurement (Student Manual)	580515 (86005-00)
1	Measurement (Instructor Guide)	580517 (86005-10)
1	Process Control (Student Manual)	580519 (86006-00)
1	Process Control (Instructor Guide)	580521 (86006-10)
1	Digital Pressure Gauge (High Range)	582387 (46761-B0)
1	Column (Large Diameter)	582394 (46901-00)
1	Rotameter	582402 (46910-00)
1	Venturi Tube	582403 (46911-00)
1	Differential-Pressure Transmitter (HART, High Range)	582408 (46920-00)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	Pneumatic Control Valve	582424 (46950-B0)
1	Solenoid Valve	582426 (46951-00)
1	Process Supports (Pressure/Flow/Level) - Add-on	588425 (46991-E0)
1	Piping and Accessories (Pressure/Flow/Level) - Add-on	588431 (46993-F0)

List of Manuals

Description	Manual number
Measurement (Workbook)	580515 (86005-00)
Measurement (Workbook (Instructor))	580517 (86005-10)
Process Control (Workbook)	580519 (86006-00)
Process Control (Workbook (Instructor))	580521 (86006-10)

Description	Manual number
Control Valves (User Guide) _____	585145 (86001-E0)
Familiarization with the Training System (User Guide) _____	8089746 (80897-46)

Table of Contents of the Manual(s)

Measurement (Workbook) (580515 (86005-00))
- 3-1 Pressure Measurement
- 3-2 Pressure Loss
- 4-1 Flowmeters
- 4-2 Centrifugal Pumps
- 5-1 Differential Pressure Level Meters
- 5-2 Bubblers
- 5-3 Wet Reference Leg

Process Control (Workbook) (580519 (86006-00))
- 1-1 Determining the Dynamic Characteristics of a Process
- 2-1 Tuning and Control of a Pressure Loop
- 2-2 Tuning and Control of a Flow Loop
- 2-3 Tuning and Control of a Level Loop
- 2-4 Cascade Control of a Level/Flow Process
- 3-1 Guided Process Control Troubleshooting
- 3-2 Non-Guided Process Control Troubleshooting

Control Valves (User Guide) (585145 (86001-E0))
- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Pressure, Flow, Level Process, Second Team Add-On – HART
588485 (3530-H0)

The Pressure, Flow, Level Process, Second Team Add-On is an add-on to the Pressure, Flow, Level, and Temperature Training System, Model 3531-0. It allows up to two groups of students to work at the same time on pressure, flow, and level experiments, one group on each side of the Process Workstation. The add-on comprises two differential pressure transmitters supporting the HART$^®$ communication protocol.

The add-on includes all the equipment required to complete the measurement, control, and troubleshooting exercises for the pressure, flow, and level processes. Transmitters supporting other communication protocols such as FOUNDATION Fieldbus are available on request.

List of Equipment

Qty	Description	Model number
1	Familiarization with the Training System - Pressure, Flow, and Level _____	8089746 (80897-46)
1	Measurement (Student Manual) _____	580515 (86005-00)

Qty	Description	Model number
1	Measurement (Instructor Guide)	580517 (86005-10)
1	Process Control (Student Manual)	580519 (86006-00)
1	Process Control (Instructor Guide)	580521 (86006-10)
1	Emergency Switch Station	582352 (5926-A0)
1	Digital Pressure Gauge (High Range)	582387 (46761-B0)
1	Column (Large Diameter)	582394 (46901-00)
1	Rotameter	582402 (46910-00)
1	Venturi Tube	582403 (46911-00)
1	Differential-Pressure Transmitter (HART, High Range)	582408 (46920-00)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	Pneumatic Control Valve	582424 (46950-B0)
1	Solenoid Valve	582426 (46951-00)
1	Color Paperless Recorder	595185 (46972-A0)
1	Instrumentation Mounting Pipe	582444 (46990-00)
1	Process Supports (Pressure/Flow/Level) - Add-on, 2nd team	588427 (46991-G0)
1	Piping and Accessories - 2nd team	588429 (46993-A0)

List of Manuals

Description	Manual number
Measurement (Workbook)	580515 (86005-00)
Measurement (Workbook (Instructor))	580517 (86005-10)
Process Control (Workbook)	580519 (86006-00)
Process Control (Workbook (Instructor))	580521 (86006-10)
Control Valves (User Guide)	585145 (86001-E0)
Familiarization with the Training System (User Guide)	8089746 (80897-46)

Table of Contents of the Manual(s)

Measurement (Workbook) (580515 (86005-00))
- 3-1 Pressure Measurement
- 3-2 Pressure Loss
- 4-1 Flowmeters
- 4-2 Centrifugal Pumps
- 5-1 Differential Pressure Level Meters
- 5-2 Bubblers
- 5-3 Wet Reference Leg

Process Control (Workbook) (580519 (86006-00))
- 1-1 Determining the Dynamic Characteristics of a Process
- 2-1 Tuning and Control of a Pressure Loop
- 2-2 Tuning and Control of a Flow Loop
- 2-3 Tuning and Control of a Level Loop
- 2-4 Cascade Control of a Level/Flow Process
- 3-1 Guided Process Control Troubleshooting
- 3-2 Non-Guided Process Control Troubleshooting

Control Valves (User Guide) (585145 (86001-E0))
- • 1 Basic Control Valve Theory
- • 2 Basic Control Valve (46950-B)
- • 3 Pneumatic Control Valve with a Positioner (46950-A)
- • 4 Control Valve with DVC2000 (46950-0)
- • 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- • 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- • 7 Electric Control Valve (46950-C)

Pressure, Flow, Level, Second team add-on
588488 (3530-K0)

The Pressure, Flow, Level Process, Second Team Add-On is an add-on to the Pressure, Flow, Level, and Temperature Training System, Model 3531-A. It allows up to two groups of students to work at the same time on pressure, flow, and level experiments, one group on each side of the Process Workstation. The add-on features two differential pressure transmitters supporting the HART® communication protocol.

The add-on includes all the equipment required to complete the measurement, control, and troubleshooting exercises for the pressure, flow, and level processes. Transmitters supporting other communication protocols such as FOUNDATION Fieldbus are available on request.

List of Equipment

Qty	Description	Model number
1	Familiarization with the Training System - Pressure, Flow, and Level	8089746 (80897-46)
1	Measurement (Student Manual)	580515 (86005-00)
1	Measurement (Instructor Guide)	580517 (86005-10)
1	Process Control (Student Manual)	580519 (86006-00)
1	Process Control (Instructor Guide)	580521 (86006-10)
1	Emergency Switch Station	582352 (5926-A0)
1	Digital Pressure Gauge (High Range)	582387 (46761-B0)
1	Column (Large Diameter)	582394 (46901-00)
1	Rotameter	582402 (46910-00)
1	Venturi Tube	582403 (46911-00)
1	Differential-Pressure Transmitter (HART, High Range)	582408 (46920-00)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	Pneumatic Control Valve	582424 (46950-B0)
1	Solenoid Valve	582426 (46951-00)
1	Color Paperless Recorder	595185 (46972-A0)
1	Instrumentation Mounting Pipe	582444 (46990-00)
1	Process Supports (Pressure/Flow/Level) - Add-on, 2nd team	588427 (46991-G0)
1	Drip Tray (Back)	582448 (46992-C0)
1	Piping and Accessories - 2nd team	588429 (46993-A0)

List of Manuals

Description	Manual number
Measurement (Workbook)	580515 (86005-00)
Measurement (Workbook (Instructor))	580517 (86005-10)

Description	Manual number
Process Control (Workbook)	580519 (86006-00)
Process Control (Workbook (Instructor))	580521 (86006-10)
Control Valves (User Guide)	585145 (86001-E0)
Familiarization with the Training System (User Guide)	8089746 (80897-46)

Table of Contents of the Manual(s)

Measurement (Workbook) (580515 (86005-00))

- 3-1 Pressure Measurement
- 3-2 Pressure Loss
- 4-1 Flowmeters
- 4-2 Centrifugal Pumps
- 5-1 Differential Pressure Level Meters
- 5-2 Bubblers
- 5-3 Wet Reference Leg

Process Control (Workbook) (580519 (86006-00))

- 1-1 Determining the Dynamic Characteristics of a Process
- 2-1 Tuning and Control of a Pressure Loop
- 2-2 Tuning and Control of a Flow Loop
- 2-3 Tuning and Control of a Level Loop
- 2-4 Cascade Control of a Level/Flow Process
- 3-1 Guided Process Control Troubleshooting
- 3-2 Non-Guided Process Control Troubleshooting

Control Valves (User Guide) (585145 (86001-E0))

- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Advanced Pressure, Flow, Level Process Add-On
588490 (3530-M0)

The Advanced Pressure, Flow, Level Process Add-On is an add-on to the Pressure, Flow, Level, and Temperature Training System, Model 3531. It allows students to perform a set of advanced process control experiments.

The experiments include feedforward control, ratio control, split-range control, and the control of second-order processes. The add-on includes a small-diameter column, an upper tank, an orifice plate, a pneumatic control valve, and some accessories.

List of Equipment

Qty	Description	Model number
1	Column (Small Diameter)	582395 (46902-00)
1	Upper Tank	588307 (46903-00)

Qty	Description	Model number
1	Orifice Plate	588315 (46912-00)
1	Pneumatic Control Valve	582424 (46950-B0)
1	Ball Valve	588365 (46952-00)
1	Piping and Accessories - Advanced	588432 (46993-G0)

List of Manuals

Description	Manual number
Flow Primary Elements (Workbook)	585135 (85996-00)
Flow Primary Elements (Workbook (Instructor))	585136 (85996-10)
Control Valves (User Guide)	585145 (86001-E0)
Advanced Process Control (Workbook)	585150 (86007-00)
Advanced Process Control (Workbook (Instructor))	585152 (86007-10)

Table of Contents of the Manual(s)

Flow Primary Elements (Workbook) (585135 (85996-00))

- 1 Orifice Plate
- 2 Pitot Tube

Control Valves (User Guide) (585145 (86001-E0))

- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Advanced Process Control (Workbook) (585150 (86007-00))

- 1-1 Feedforward Control
- 1-2 Ratio Control
- 1-3 Split-range Control
- 2-1 Second-Order Non-Interacting Processes
- 2-2 Second-Order Interacting Processes

Temperature Process Training System (Allen-Bradley) – HART
582455 (3531-00)
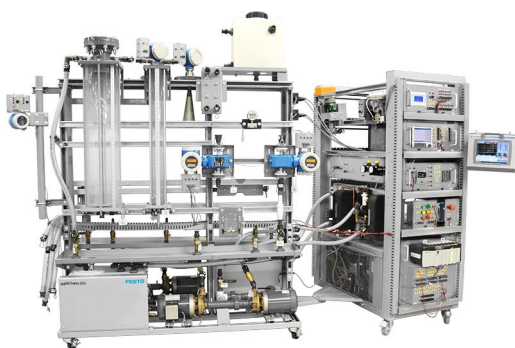
The Temperature Process Training System – HART introduces students to temperature processes and their associated instruments and control. It features the HART Temperature Transmitter and Allen-Bradley Variable Frequency Drives.

This model needs a PLC of Series 3539 to be fully functional.

List of Equipment

Qty	Description	Model number
1	Familiarization with the Training System (User Guide)	8089750 (80897-50)
1	Measurement (Student Manual)	580525 (86009-00)
1	Measurement (Instructor Guide)	580527 (86009-10)
1	Process Control (Student Manual)	580529 (86010-00)
1	Process Control (Instructor Guide)	580531 (86010-10)
1	Emergency Switch Station	582352 (5926-A0)
1	Process Workstation (Temperature, Pressure, Flow, and Level)	582388 (46801-E0)
1	Instrumentation Workstation (With Heating/Cooling Unit)	582391 (46900-D0)
1	Brazed Plate Heat Exchanger	582400 (46905-00)
1	J-Type Thermocouple	582406 (46916-00)
1	Platinum RTD 100	582407 (46917-00)
1	Temperature Transmitter (HART)	582422 (46940-00)
1	Three-Way Pneumatic Control Valve	582430 (46955-B0)
1	Electrical Unit	592680 (46970-10)
1	Pneumatic Unit	582433 (46971-A0)
1	Color Paperless Recorder	595185 (46972-A0)
4	AC Variable Frequency Drive (Ethernet)	8122682 (46975-20)
1	Instrumentation Mounting Pipe	582444 (46990-00)
1	Process Supports (Temperature)	582446 (46991-D0)
1	Drip Tray (Front)	582447 (46992-B0)
1	Drip Tray (Back)	582448 (46992-C0)
1	Piping and Accessories (Temperature) - Basic System	582449 (46993-C0)
1	Electrical Distribution Box	582453 (46997-00)

List of Manuals

Description	Manual number
Measurement (Workbook)	580525 (86009-00)
Measurement (Workbook (Instructor))	580527 (86009-10)
Process Control (Workbook)	580529 (86010-00)
Process Control (Workbook (Instructor))	580531 (86010-10)
Control Valves (User Guide)	585145 (86001-E0)
Familiarization with the Training System (User Guide)	8089750 (80897-50)

Table of Contents of the Manual(s)

Measurement (Workbook) (580525 (86009-00))
- 3-1 Resistance Temperature Detectors (RTDs)
- 3-2 Thermocouples
- 4-1 Basic Thermal Energy Transfer with a Heat Exchanger

Process Control (Workbook) (580529 (86010-00))
- 1-1 Determining the Dynamic Characteristics of a Process
- 2-1 Tuning and Control of a Temperature Loop
- 3-1 Guided Process Control Troubleshooting

Control Valves (User Guide) (585145 (86001-E0))
- • 1 Basic Control Valve Theory
- • 2 Basic Control Valve (46950-B)
- • 3 Pneumatic Control Valve with a Positioner (46950-A)
- • 4 Control Valve with DVC2000 (46950-0)
- • 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- • 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- • 7 Electric Control Valve (46950-C)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	CompactLogix PLC Bundle – Educational	588522 (3539-80)
1	Compressor	588108 (6410-C0)
1	Touch Screen Graphic Terminal (Allen-Bradley) - 26.4 cm (10.4 in)	8103425 (46973-10) [1]
1	Calibration Kit	588416 (46980-00)

System Specifications

Parameter	Value
Physical Characteristics	
Required Floor Space (H x W x D)	On Casters, 2400 x 4000 x 1200 mm (94.5 x 157.5 x 47.2 in)

Advanced Temperature Process Add-on – HART
582461 (3531-20)

The Advanced Temperature Process Add-on – HART features two HART Electromagnetic Flow Transmitters. The addition of this add-on to the Pressure, Flow, Level, and Temperature Process Training Systems offers the possibility to perform a set of advanced temperature control experiments. The main feature of the add-on resides in the use of electromagnetic flowmeters and RTDs coupled to the energy manager to obtain precise energy balances.

List of Equipment

Qty	Description	Model number
3	Platinum RTD 100	582407 (46917-00)
1	Electromagnetic Flow Transmitter (HART, Transmitter on the right)	582413 (46922-00)
1	Electromagnetic Flow Transmitter (HART, Transmitter on the right)	582419 (46922-10)
1	Energy Manager	582435 (46974-00)
1	Accessories (Temperature) - Advanced	582450 (46993-D0)

List of Manuals

Description	Manual number
Electromagnetic Flow Meters (Workbook)	585123 (85990-00)
Electromagnetic Flow Meters (Workbook (Instructor))	585126 (85990-10)
Fundamentals of Heat Exchange (Workbook)	585230 (87205-00)
Heat Exchangers and Advanced Temperature Measurement (Workbook)	8089754
Heat Exchangers and Advanced Temperature Measurement (Workbook (Instructor))	8089758

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[1] Requires an Allen-Bradley PLC.

Table of Contents of the Manual(s)

Electromagnetic Flow Meters (Workbook) (585123 (85990-00))

Heat Exchangers and Advanced Temperature Measurement (Workbook) (8089754)

Pressure/Flow/Level Process Training System (Allen-Bradley) – HART
582464 (3531-A0)

The Pressure/Flow/Level Process Training System – HART introduces students to pressure, flow, and level processes and their associated instruments and control. It features two HART Differential Pressure Transmitters, one high-range and one low-range. It also features an Ethernet/IP Allen-Bradley Variable Frequency Drive.

This model needs a PLC of Series 3539 to be fully functional.

List of Equipment

Qty	Description	Model number
1	Familiarization with the Training System - Pressure, Flow, and Level	8089746 (80897-46)
1	Measurement (Student Manual)	580515 (86005-00)
1	Measurement (Instructor Guide)	580517 (86005-10)
1	Process Control (Student Manual)	580519 (86006-00)
1	Process Control (Instructor Guide)	580521 (86006-10)
1	Emergency Switch Station	582352 (5926-A0)
1	Digital Pressure Gauge (High Range)	582387 (46761-B0)
1	Process Workstation (Pressure, Flow, and Level)	582390 (46801-F0)
1	Instrumentation Workstation (Assembled)	588306 (46900-G0)
1	Column (Large Diameter)	582394 (46901-00)
1	Rotameter	582402 (46910-00)
1	Venturi Tube	582403 (46911-00)
1	Differential-Pressure Transmitter (HART, High Range)	582408 (46920-00)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	Pneumatic Control Valve	582424 (46950-B0)
1	Solenoid Valve	582426 (46951-00)

Qty	Description	Model number
1	Electrical Unit	592680 (46970-10)
1	Pneumatic Unit	582433 (46971-A0)
1	Color Paperless Recorder	595185 (46972-A0)
1	AC Variable Frequency Drive (Ethernet)	8122680 (46975-10)
1	Instrumentation Mounting Pipe	582444 (46990-00)
1	Process Supports (Pressure/Flow/Level/Temperature)	582445 (46991-C0)
1	Drip Tray (Front)	582447 (46992-B0)
1	Piping and Accessories (Pressure/Flow/Level, Allen-Bradley) – Basic System	582451 (46993-E0)

List of Manuals

Description	Manual number
Measurement (Workbook)	580515 (86005-00)
Measurement (Workbook (Instructor))	580517 (86005-10)
Process Control (Workbook)	580519 (86006-00)
Process Control (Workbook (Instructor))	580521 (86006-10)
Control Valves (User Guide)	585145 (86001-E0)
Familiarization with the Training System (User Guide)	8089746 (80897-46)

Table of Contents of the Manual(s)

Measurement (Workbook) (580515 (86005-00))
- 3-1 Pressure Measurement
- 3-2 Pressure Loss
- 4-1 Flowmeters
- 4-2 Centrifugal Pumps
- 5-1 Differential Pressure Level Meters
- 5-2 Bubblers
- 5-3 Wet Reference Leg

Process Control (Workbook) (580519 (86006-00))
- 1-1 Determining the Dynamic Characteristics of a Process
- 2-1 Tuning and Control of a Pressure Loop
- 2-2 Tuning and Control of a Flow Loop
- 2-3 Tuning and Control of a Level Loop
- 2-4 Cascade Control of a Level/Flow Process
- 3-1 Guided Process Control Troubleshooting
- 3-2 Non-Guided Process Control Troubleshooting

Control Valves (User Guide) (585145 (86001-E0))
- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	CompactLogix PLC Bundle – Educational	588522 (3539-80) [2]
1	Compressor	588108 (6410-C0)
1	Touch Screen Graphic Terminal (Allen-Bradley) - 26.4 cm (10.4 in)	8103425 (46973-10) [3]
1	Calibration Kit	588416 (46980-00)

System Specifications

Parameter	Value
Physical Characteristics	
Required Floor Space (H x W x D)	On Casters, 2400 x 4000 x 1200 mm (94.5 x 157.5 x 47.2 in)

Temperature Process Add-On (Allen-Bradley) – HART
582470 (3531-C0)

The Temperature Process Add-On – HART is an add-on to the Pressure/Flow/Level Process Training System – HART, Model 3531-A. The add-on comprises all the equipment required to complete the measurement, control, and troubleshooting exercises for temperature processes, including a HART temperature transmitter and three Allen-Bradley Variable Frequency Drives. A variety of optional heat exchangers are available for advanced training in temperature process control.

List of Equipment

Qty	Description	Model number
1	Familiarization with the Training System (User Guide)	8089750 (80897-50)
1	Measurement (Student Manual)	580525 (86009-00)
1	Measurement (Instructor Guide)	580527 (86009-10)
1	Process Control (Student Manual)	580529 (86010-00)
1	Process Control (Instructor Guide)	580531 (86010-10)
1	Pumps Add-On (Temperature)	582396 (46904-A0)
1	2nd Pump Add-On	582398 (46904-B0)
1	Brazed Plate Heat Exchanger	582400 (46905-00)
1	Heating/Cooling Unit	763447 (46908-00)
1	J-Type Thermocouple	582406 (46916-00)
1	Platinum RTD 100	582407 (46917-00)
1	Temperature Transmitter (HART)	582422 (46940-00)
1	Three-Way Pneumatic Control Valve	582430 (46955-B0)
3	AC Variable Frequency Drive (Ethernet)	8122682 (46975-20)
1	Drip Tray (Back)	582448 (46992-C0)
1	Piping and Accessories (Temperature) - Add-on	582452 (46993-J0)
1	Electrical Distribution Box	582453 (46997-00)

List of Manuals

Description	Manual number
Measurement (Workbook)	580525 (86009-00)

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[2] Can be replaced by one of the optional controllers.

[3] Requires an Allen-Bradley PLC.

Description	Manual number
Measurement (Workbook (Instructor))	580527 (86009-10)
Process Control (Workbook)	580529 (86010-00)
Process Control (Workbook (Instructor))	580531 (86010-10)
Control Valves (User Guide)	585145 (86001-E0)
Familiarization with the Training System (User Guide)	8089750 (80897-50)

Table of Contents of the Manual(s)

Measurement (Workbook) (580525 (86009-00))
- • 3-1 Resistance Temperature Detectors (RTDs)
- • 3-2 Thermocouples
- • 4-1 Basic Thermal Energy Transfer with a Heat Exchanger

Process Control (Workbook) (580529 (86010-00))
- • 1-1 Determining the Dynamic Characteristics of a Process
- • 2-1 Tuning and Control of a Temperature Loop
- • 3-1 Guided Process Control Troubleshooting

Control Valves (User Guide) (585145 (86001-E0))
- • 1 Basic Control Valve Theory
- • 2 Basic Control Valve (46950-B)
- • 3 Pneumatic Control Valve with a Positioner (46950-A)
- • 4 Control Valve with DVC2000 (46950-0)
- • 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- • 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- • 7 Electric Control Valve (46950-C)

Pressure/Flow/Level Process Training System (Siemens) – HART 589668 (3531-E0)

The Pressure/Flow/Level Process Training System – HART introduces students to pressure, flow, level processes and their associated instruments and control. It features two HART Differential Pressure Transmitters, one high-range and one low-range. It also features an PROFINET Siemens Variable Frequency Drive.

This model needs a PLC of Series 3539 to be fully functional.

List of Equipment

Qty	Description	Model number
1	System test (at FD-CA, free of charge)	8132961
1	Familiarization with the Training System - Pressure, Flow, and Level	8089746 (80897-46)
1	Control Valves (User Guide)	585145 (86001-E0)
1	Measurement (Student Manual)	580515 (86005-00)
1	Measurement (Instructor Guide)	580517 (86005-10)
1	Process Control (Student Manual)	580519 (86006-00)
1	Process Control (Instructor Guide)	580521 (86006-10)
1	Emergency Switch Station	582352 (5926-A0)
1	Digital Pressure Gauge (High Range)	582387 (46761-B0)
1	Process Workstation (Pressure, Flow, and Level)	582390 (46801-F0)

Qty	Description	Model number
1	Instrumentation Workstation (Assembled)	588306 (46900-G0)
1	Column (Large Diameter)	582394 (46901-00)
1	Rotameter	582402 (46910-00)
1	Venturi Tube	582403 (46911-00)
1	Differential-Pressure Transmitter (HART, High Range)	582408 (46920-00)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	Pneumatic Control Valve	582424 (46950-B0)
1	Solenoid Valve	582426 (46951-00)
1	Electrical Unit	592680 (46970-10)
1	Pneumatic Unit	582433 (46971-A0)
1	Color Paperless Recorder	595185 (46972-A0)
1	AC Drive (Ethernet) - Single-Phase AC Supply	589673 (46975-E0)
1	Instrumentation Mounting Pipe	582444 (46990-00)
1	Process Supports (Pressure/Flow/Level/Temperature)	582445 (46991-C0)
1	Drip Tray (Front)	582447 (46992-B0)
1	Piping and Accessories (Pressure/Flow/Level, Siemens) – Basic System	592689 (46993-N0)

List of Manuals

Description	Manual number
Measurement (Workbook)	580515 (86005-00)
Measurement (Workbook (Instructor))	580517 (86005-10)
Process Control (Workbook)	580519 (86006-00)
Process Control (Workbook (Instructor))	580521 (86006-10)
Control Valves (User Guide)	585145 (86001-E0)
Familiarization with the Training System (User Guide)	8089746 (80897-46)

Table of Contents of the Manual(s)

Measurement (Workbook) (580515 (86005-00))

Process Control (Workbook) (580519 (86006-00))

- 2-4 Cascade Control of a Level/Flow Process
- 3-1 Guided Process Control Troubleshooting
- 3-2 Non-Guided Process Control Troubleshooting

Control Valves (User Guide) (585145 (86001-E0))
- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	S7-1500 PLC Bundle HART – Educational	589669 (3539-P0) [4]
1	S7-1500 PLC Bundle – Educational	589670 (3539-S0) [5]
1	Compressor	588108 (6410-C0)
1	Industrial PC HMI (Siemens)	589672 (46973-A0)
1	Calibration Kit	588416 (46980-00)

Software

Qty	Description	Model number
1	Fuzzy Logic Software Add-on to RSLogix 5000 (Educational)	587902 (5938-00) [6]
1	Fuzzy Logic Software Add-on to RSLogix 5000 (Commercial)	587903 (5938-A0) [7]
1	HART Software Configurator	588420 (46982-00)
1	Step 7 professional and WinCC Advanced, 6 users (perpetual) + 20 Students (1 year), Educational (81646-50)	8164650
1	Step 7 professional and WinCC Advanced, 20 Students (1 year), Educational	8164652 (81646-52)

Boiler Simulation (Water/Air) Add-On (Allen-Bradley, Without Temperature Process) – HART 582474 (3531-K0)

The Boiler Simulation (Water/Air) Add-On (Without Temperature Process) – HART is an inherently safe boiler simulator which is not pressurized and works with water at room temperature. The add-on features a HART Low-Range Differential-Pressure Transmitter and an Allen-Bradley AC Variable Speed Drive (Ethernet).

The key features of a boiling process are replicated with a controlled flow of air injected at the base of a process column containing a controllable level of water. Up to three elements and three control loops (2 PID loops and 1 calibrator) are involved in the control of the level of water in the drum of the boiler.

The boiling process is recreated by regulating the flow of air injected in the column while operating a second pump which drains the column to simulate evaporation of water. The Boiler Simulation system is a synthesis of many industrial control notions and involves multiple control loops as well as feedforward and cascade control.

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[4] This bundle includes a Siemens S7-1500 PLC, one copy of STEP 7 Software, one copy of WinCC.

[5] This bundle includes a Siemens S7-1500 PLC, a Distributed I/O Module (HART), one copy of STEP 7 Software , one copy of WinCC and one copy of the Process Device Manager Software.

[6] An advanced process control strategy. No teachware.

[7] An advanced process control strategy. No teachware.

The Boiler Simulation is an add-on to the Pressure, Flow, Level, and Temperature Process Training Systems and may include a pump and a drive if required. The boiler system can only be used by one team at a time. A controller with a minimum of three inputs and two PID loops capable of both cascade and feedforward control and a 4-20 mA calibrator are also necessary. As both cascade and feedforward control schemes are used, the Advanced Pressure, Flow, and Level Process Add-On, Model 3530-M0, is required. It is recommended for students to be familiar with these topics beforehand.

List of Equipment

Qty	Description	Model number
1	Boiler Control (Student)	580509 (85993-00)
1	Boiler Control (Instructor)	580511 (85993-10)
1	2nd Pump Add-On	582398 (46904-B0)
1	Orifice Plate (Air- High Flow)	582404 (46914-00)
1	Rotameter (Air)	582405 (46915-00)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	Solenoid Valve (Air)	582427 (46951-A0)
1	Pneumatic Control Valve (Air)	582428 (46953-00)
1	AC Variable Frequency Drive (Ethernet)	8122680 (46975-10)

List of Manuals

Description	Manual number
Boiler Control (Workbook)	580509 (85993-00)
Boiler Control (Workbook (Instructor))	580511 (85993-10)
Control Valves (User Guide)	585145 (86001-E0)

Table of Contents of the Manual(s)

Boiler Control (Workbook) (580509 (85993-00))
- 1 Single-Element Control
- 2 Two-Element Control
- 3 Three-Element Control

Control Valves (User Guide) (585145 (86001-E0))
- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Boiler Simulation (Water/Air) Add-On – HART (needs the Temperature, and Advanced pressure, flow, level)
582478 (3531-M0)

The Boiler Simulation is an inherently safe boiler simulator which is not pressurized and works with water at room temperature. The add-on features a HART Low-Range Differential-Pressure Transmitter.

The key features of a boiling process are replicated with a controlled flow of air injected at the base of a process column containing a controllable level of water. Up to three elements and three control loops (2 PID loops and 1 calibrator) are involved in the control of the level of water in the drum of the boiler.

The boiling process is recreated by regulating the flow of air injected in the column while operating a second pump which drains the column to simulate evaporation of water. The Boiler Simulation system is a synthesis of many industrial control notions and involves multiple control loops as well as feedforward and cascade control.

The Boiler Simulation is an add-on to the Pressure, Flow, Level, and Temperature Process Training Systems and may include a pump and a drive if required. The boiler system can only be used by one team at a time. A controller with a minimum of three inputs and two PID loops capable of both cascade and feedforward control and a 4-20 mA calibrator are also necessary. As both cascade and feedforward control schemes are used, the Advanced Pressure, Flow, and Level Process Add-On, Model 3530-M0, is required. It is recommended for students to be familiar with these topics beforehand.

List of Equipment

Qty	Description	Model number
1	Boiler Control (Student)	580509 (85993-00)
1	Boiler Control (Instructor)	580511 (85993-10)
1	Orifice Plate (Air- High Flow)	582404 (46914-00)
1	Rotameter (Air)	582405 (46915-00)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	Solenoid Valve (Air)	582427 (46951-A0)
1	Pneumatic Control Valve (Air)	582428 (46953-00)

List of Manuals

Description	Manual number
Boiler Control (Workbook)	580509 (85993-00)
Boiler Control (Workbook (Instructor))	580511 (85993-10)
Control Valves (User Guide)	585145 (86001-E0)

Table of Contents of the Manual(s)

Boiler Control (Workbook) (580509 (85993-00))
- 1 Single-Element Control
- 2 Two-Element Control
- 3 Three-Element Control

Control Valves (User Guide) (585145 (86001-E0))
- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Boiler Simulation (Water/Air) Add-On - Siemens - HART (needs the Advanced pressure, flow, level)
589883 (3531-T0)

This Boiler Simulation is an inherently safe boiler simulator which is not pressurized and works with water at room temperature. The add-on features a HART Low-Range Differential-Pressure Transmitter and an Siemens AC Variable Speed Drive (PROFINET).

The key features of a boiling process are replicated with a controlled flow of air injected at the base of a process column containing a controllable level of water. Up to three elements and three control loops (2 PID loops and 1 calibrator) are involved in the control of the level of water in the drum of the boiler.

The boiling process is recreated by regulating the flow of air injected in the column while operating a second pump which drains the column to simulate evaporation of water. The Boiler Simulation system is a synthesis of many industrial control notions and involves multiple control loops as well as feedforward and cascade control.

The Boiler Simulation is an add-on to the Pressure, Flow, Level, and Temperature Process Training Systems and may include a pump and a drive if required. The boiler system can only be used by one team at a time. A controller with a minimum of three inputs and two PID loops capable of both cascade and feedforward control and a 4-20 mA calibrator are also necessary. As both cascade and feedforward control schemes are used, the Advanced Pressure, Flow, and Level Process Add-On, Model 3530-M0, is required. It is recommended for students to be familiar with these topics beforehand.

List of Equipment

Qty	Description	Model number
1	Boiler Control (Student)	580509 (85993-00)
1	Boiler Control (Instructor)	580511 (85993-10)
1	2nd Pump Add-On	582398 (46904-B0)
1	Orifice Plate (Air- High Flow)	582404 (46914-00)
1	Rotameter (Air)	582405 (46915-00)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	Solenoid Valve (Air)	582427 (46951-A0)
1	Pneumatic Control Valve (Air)	582428 (46953-00)
1	AC Drive (Ethernet) - Single-Phase AC Supply	589673 (46975-E0)

List of Manuals

Description	Manual number
Boiler Control (Workbook)	580509 (85993-00)
Boiler Control (Workbook (Instructor))	580511 (85993-10)
Control Valves (User Guide)	585145 (86001-E0)

Table of Contents of the Manual(s)

Boiler Control (Workbook) (580509 (85993-00))
- 1 Single-Element Control
- 2 Two-Element Control
- 3 Three-Element Control

Control Valves (User Guide) (585145 (86001-E0))
- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)

- • 3 Pneumatic Control Valve with a Positioner (46950-A)
- • 4 Control Valve with DVC2000 (46950-0)
- • 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- • 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- • 7 Electric Control Valve (46950-C)

Boiler Simulation (Water/Air) Add-On - Siemens - HART (needs the Air Process, and the Advanced Pressure, Flow, Level)
589884 (3531-U0)

This Boiler Simulation is an add-on consisting of a Pumping Unit, a Differential-Pressure Transmitter (HART, Low Range), and an Siemens AC Drive (PROFINET).

List of Equipment

Qty	Description	Model number
1	Boiler Control (Student)	580509 (85993-00)
1	Boiler Control (Instructor)	580511 (85993-10)
1	2nd Pump Add-On	582398 (46904-B0)
1	Differential-Pressure Transmitter (HART, Low Range)	582410 (46921-00)
1	AC Drive (Ethernet) - Single-Phase AC Supply	589673 (46975-E0)

List of Manuals

Description	Manual number
Boiler Control (Workbook)	580509 (85993-00)
Boiler Control (Workbook (Instructor))	580511 (85993-10)

Table of Contents of the Manual(s)

Boiler Control (Workbook) (580509 (85993-00))
- • 1 Single-Element Control
- • 2 Two-Element Control
- • 3 Three-Element Control

Air Pressure/Flow Process Add-On
588507 (3533-A0)

The Air Pressure/Flow Process Add-On is available as an add-on to the Pressure, Flow, Level, and Temperature Process Training Systems, Model 3531. This add-on allows measurement and control experiments related to pressure and flow of compressed air to be performed.

List of Equipment

Qty	Description	Model number
1	Familiarization with the Training System (Instructor)	8089744 (80897-44)
1	Measurement (Student)	585119 (85988-00)
1	Measurement (Instructor)	585120 (85988-10)
1	Process Control (Student)	585121 (85989-00)
1	Process Control (Instructor)	585122 (85989-10)
1	Air Tank (Large)	588312 (46906-00)
1	Air Tank (Small)	588313 (46906-A0)
1	Muffler Assembly	588314 (46907-00)
1	Orifice Plate (Air- High Flow)	582404 (46914-00)
1	Rotameter (Air)	582405 (46915-00)
1	Solenoid Valve (Air)	582427 (46951-A0)
1	Pneumatic Control Valve (Air)	582428 (46953-00)
1	Instrumentation Mounting Pipe	582444 (46990-00)
1	Piping and Accessories (Air)	588430 (46993-B0)

List of Manuals

Description	Manual number
Measurement (Workbook)	585119 (85988-00)
Measurement (Workbook (Instructor))	585120 (85988-10)
Process Control (Workbook)	585121 (85989-00)
Process Control (Workbook (Instructor))	585122 (85989-10)
Control Valves (User Guide)	585145 (86001-E0)
Familiarization with the Training System (User Guide)	8089744 (80897-44)

Table of Contents of the Manual(s)

Measurement (Workbook) (585119 (85988-00))
- 3-1 Pressure Measurements
- 3-2 Pressure Loss
- 4-1 Flowmeters

Process Control (Workbook) (585121 (85989-00))
- 1-1 Determining the Dynamic Characteristics of an Air Process
- 2-1 Tuning and Control of a Pressure Loop
- 2-2 Tuning and Control of a Flow Loop
- 3-1 Guided Process Control Troubleshooting

Control Valves (User Guide) (585145 (86001-E0))
- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

ControlLogix PLC Bundle – Educational
588519 (3539-50)
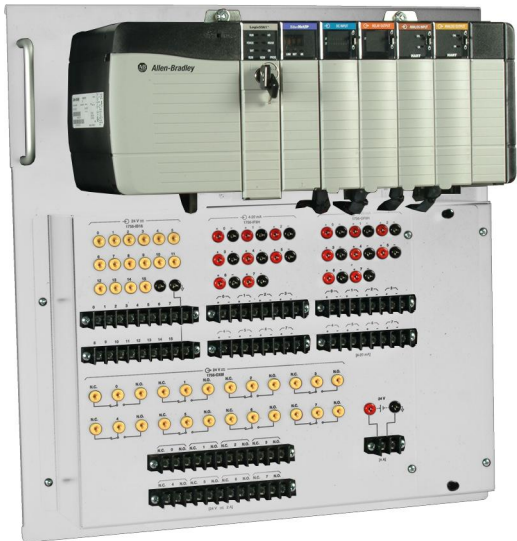
This bundle includes an Allen-Bradley ControlLogix PLC, one copy of RSLogix 5000 Full Edition and a user guide.

List of Equipment

Qty	Description	Model number
1	ControlLogix and CompactLogix Programmable Logic Controllers (User Guide)	585159 (86030-E0)
1	Studio 5000 Logix Designer Full Edition	587895 (5935-10)
1	Programmable Logic Controller (AB ControlLogix)	589122 (46965-10)

Manual

Description	Manual number
ControlLogix and CompactLogix Programmable Logic Controllers (User Guide) _____	585159 (86030-E0)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

System Specifications

Parameter	Value
Power Requirement	
Current	4.0 A
Inputs	
Analog (8)	4-20 mA analog inputs
Digital (16)	24 V dc contact inputs
Outputs	
Analog (8)	4-20 mA analog outputs
Digital (8)	24 V dc relays (normally open and normally closed contacts)
Number of PID loops	8
Number of fault switches	10
Communication	Ethernet
Communication protocol	HART compatible
Configuration	From a computer using RSLogix 5000

MicroLogix PLC Bundle – Educational
588521 (3539-70)

This bundle includes a MicroLogix PLC, one copy of RSLogix 500, a communication cable, and a user guide.

List of Equipment

Qty	Description	Model number
1	PLC Software (RSLogix Micro, Educational) _____	587552 (3245-A0)
1	Communication Cable (Allen-Bradley) _____	587566 (3246-40)
1	Programmable Logic Controller (AB MicroLogix 1100) _____	588381 (46964-00)

Manual

Description	Manual number
MicroLogix 1100 Programmable Logic Controller (User Guide) _____	585161 (86032-E0)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

System Specifications

Parameter	Value
Power Requirement	
Current	1.5 A
Inputs	
Analog (2)	4-20 mA analog inputs
Digital (10)	24 V dc contact inputs
Outputs	
Analog (2)	4-20 mA analog outputs
Digital (6)	24 V dc relays (2 relays - 1.1 A, 2 high-speed FET relays - 0.1 A, 2 FET relays - 1.5 A)
Number of PID loops	2
Number of fault switches	8
Communication	RS232/RS485 protocols and Ethernet
Configuration	From a computer using RSLogix 500

CompactLogix PLC Bundle – Educational
588522 (3539-80)

This bundle includes a CompactLogix PLC, one copy of RSLogix 5000 Lite Edition, and a user guide.

List of Equipment

Qty	Description	Model number
1	ControlLogix and CompactLogix Programmable Logic Controllers (User Guide) _____	585159 (86030-E0)
1	Studio 5000 Logix Designer Lite Edition _____	587890 (5935-00)
1	Programmable Logic Controller (AB CompactLogix) _____	589123 (46966-10)

Manual

Description	Manual number
ControlLogix and CompactLogix Programmable Logic Controllers (User Guide) _____	585159 (86030-E0)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

System Specifications

Parameter	Value
Power Requirement	
Current	2.1 A
Inputs	
Analog (8)	4-20 mA analog inputs
Digital (16)	24 V dc contact inputs
Outputs	
Analog (8)	4-20 mA analog outputs
Digital (16)	24 V dc relays
Number of PID loops	8
Number of fault switches	10
Communication	Ethernet
Configuration	From a computer using RSLogix 5000

MicroLogix PLC Bundle – Commercial
588514 (3539-C0)

This bundle includes a ControlLogix PLC, one copy of RSLogix 5000 Full Edition (Commercial), and a user guide.

List of Equipment

Qty	Description	Model number
1	PLC Software (RSLogix Micro, Commercial) _____	587555 (3245-B0)
1	Communication Cable (Allen-Bradley) _____	587566 (3246-40)
1	Programmable Logic Controller (AB MicroLogix 1100) _____	588381 (46964-00)

Manual

Description	Manual number
MicroLogix 1100 Programmable Logic Controller (User Guide) _____	585161 (86032-E0)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

System Specifications

Parameter	Value
Power Requirement	
Current	1.5 A
Inputs	
Analog (2)	4-20 mA analog inputs
Digital (10)	24 V dc contact inputs
Outputs	
Analog (2)	4-20 mA analog outputs
Digital (6)	24 V dc relays (2 relays - 1.1 A, 2 high-speed FET relays - 0.1 A, 2 FET relays - 1.5 A)
Number of PID loops	2
Number of fault switches	8
Communication	RS232/RS485 protocols and Ethernet
Configuration	From a computer using RSLogix 500

CompactLogix PLC Bundle – Commercial
588515 (3539-D0)

This bundle includes a CompactLogix PLC, one copy of RSLogix 5000 Lite Edition (Commercial), and a user guide.

List of Equipment

Qty	Description	Model number
1	ControlLogix and CompactLogix Programmable Logic Controllers (User Guide) _____	585159 (86030-E0)
1	Studio 5000 Logix Designer Lite Edition (Commercial) _____	587892 (5935-A0)
1	Programmable Logic Controller (AB CompactLogix) _____	589123 (46966-10)

Manual

Description	Manual number
ControlLogix and CompactLogix Programmable Logic Controllers (User Guide) _____	585159 (86030-E0)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

System Specifications

Parameter	Value
Power Requirement	
Current	2.1 A
Inputs	
Analog (8)	4-20 mA analog inputs
Digital (16)	24 V dc contact inputs
Outputs	
Analog (8)	4-20 mA analog outputs
Digital (16)	24 V dc relays
Number of PID loops	8
Number of fault switches	10
Communication	Ethernet
Configuration	From a computer using RSLogix 5000

S7-1500 PLC Bundle HART – Educational
589669 (3539-P0)

This bundle includes a Siemens S7-1500 PLC, a Distributed I/O Module (HART), one copy of STEP 7 Software, one copy of WinCC and one copy of the Process Device Manager Software.

List of Equipment

Qty	Description	Model number
1	Programmable Logic Controller (S7-1516) _____	589671 (46962-00)
1	Distributed I/O Module (HART) _____	589674 (46976-00)
1	TIA Portal PLC Software (Step 7 Professional) with Process Device Manager (PDM) _____	589676 (46986-00)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

S7-1500 PLC Bundle – Educational
589670 (3539-S0)

This bundle includes a Siemens S7-1500 PLC, one copy of STEP 7 and WinCC Software.

List of Equipment

Qty	Description	Model number
1	Programmable Logic Controller (S7-1516) _____	589671 (46962-00)
1	TIA Portal PLC Software (Step 7 Professional) _____	592687 (46986-10)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

Equipment Description

PLC Software (RSLogix Micro, Educational)
587552 (3245-A0)
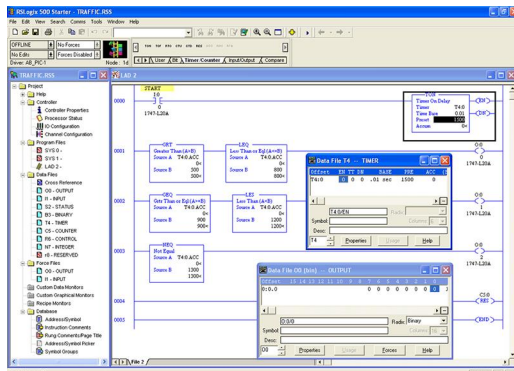
The RSLogix Micro software is a tool to design and implement ladder programs for the Allen-Bradley MicroLogix™ family of processors (it cannot be used with SLC 500 controllers). It is a Windows®-based application produced by Rockwell Software that allows PLC programming using a personal computer.

The free-form ladder of RSLogix Micro lets students concentrate on the application logic rather than using the proper syntax when editing programs. Several other features of RSLogix Micro greatly facilitate PLC programming, such as a project verifier, drag-and-drop editing, and search-and-replace functions. The

PLC can be programmed via either an RS-232 port or an Ethernet port on the PLC processor. This software comes with RSLinx™, which provides connectivity between the PLC and the computer.

The software is available with either an educational license (Model 3245-A) or as a commercial license (Model 3245-B).

Specifications

Parameter	Value
Computer Requirements	A currently available personal computer with USB 2.0 ports, running under one of the following operating systems: Windows® 7 or Windows® 8.

PLC Software (RSLogix Micro, Commercial)
587555 (3245-B0)
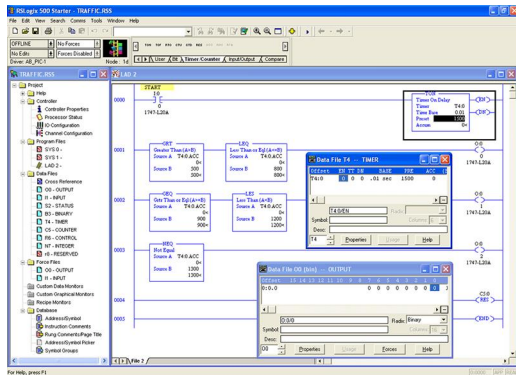
The RSLogix Micro software is a tool to design and implement ladder programs for the Allen-Bradley MicroLogix™ family of processors (it cannot be used with SLC 500 controllers), such as the Programmable Logic Controller (MicroLogix), Model 46964. It is a Windows®-based application, produced by Rockwell Software, that allows PLC programming using a personal computer.

The free-form ladder of RSLogix Micro lets students concentrate on the application logic rather than using the proper syntax when editing programs. Several other features of RSLogix Micro greatly facilitate PLC programming, such as a project verifier, drag-and-drop editing, and search-and-replace functions. The PLC can be programmed via either an RS-232 port or an Ethernet port on the PLC processor. This software comes with RSLinx™, which provides connectivity between the PLC and the computer.

The software is available with either an educational license (Model 3245-A) or as a commercial license (Model 3245-B).

Specifications

Parameter	Value
Computer Requirements	A currently available personal computer Pentium type with RS-232 serial port, running under one of the Microsoft® operating systems, Windows® 2000, Windows® XP, Windows® Vista or Windows® 7, is required.

Communication Cable (Allen-Bradley)
587566 (3246-40)

The communication cable is an RS-232-C serial cable specifically designed to connect a personal computer to an Allen-Bradley programmable logic controller, thus making it possible to program and monitor the PLC.

Specifications

Parameter	Value
Communication Cable	
Type	8 pin mini DIN to 9 pin D shell
Length	2 m (6.5 ft)

Emergency Switch Station
582352 (5926-A0)

The Emergency Switch Station consists of a mushroom-type push-button that opens its circuit when the button is pressed in order to cut the power to some of the 24 V dc outputs of the electrical unit, the pneumatic unit, and the pump drive.

Specifications

Parameter	Value
Physical Characteristics	
Dimensions (H x W x D)	TBE
Net Weight	TBE

Studio 5000 Logix Designer Lite Edition
587890 (5935-00)

Studio 5000 Logix Designer is a Windows-based application, produced by Rockwell Software™, used to build programs for CompactLogix PLCs.

Studio 5000 Logix Designer provides a powerful integrated interface allowing users to easily build programs using four programming languages: relay ladder, structured text, sequential function chart, and function block diagram. The software allows students to concentrate on the logic aspects of PLC programming instead of spending time on complex syntax. It also features drag-and-drop editing, search-and-replace functions, and tools for verifying programs before running them on a PLC. Studio 5000 Logix Designer can be used to program a PLC via the built-in RS-232 port or via an Ethernet link. The software comes with RSLinx lite which provides the functionality required to support RSLogix and RSNetWorx.
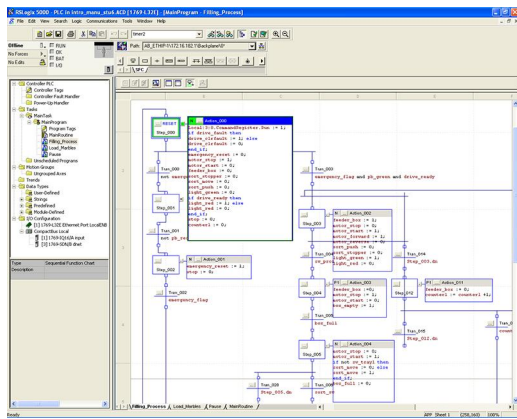
The following versions are available:

- 5935-0: Studio 5000 Logix Designer Lite Edition (Educationnal)
- 5935-A: Studio 5000 Logix Designer Lite Edition (Commercial)
- 5935-1: Studio 5000 Logix Designer Full Edition (Educationnal)
- 5935-B: Studio 5000 Logix Designer Full Edition (Commercial)

Specifications

Parameter	Value
Included Software	RSLogix 5000 and RSLinx Lite
Available Languages	Relay ladder, structured text, sequential function chart, and function block diagram.
Computer Requirements	A currently available personal computer running under one of the following operating systems: Windows® 7 or Windows® 8.

Studio 5000 Logix Designer Full Edition
587895 (5935-10)
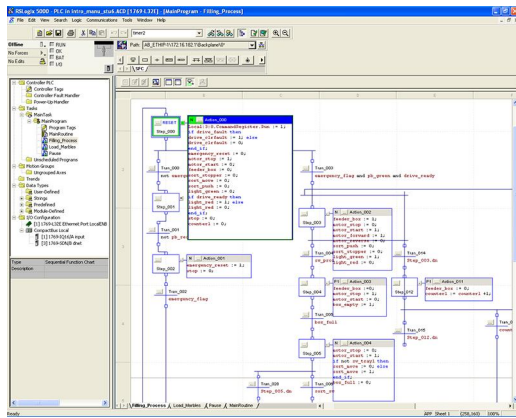
Studio 5000 Logix Designer is a Windows-based application, produced by Rockwell Software™, used to build programs for PLCs.

Studio 5000 Logix Designer provides a powerful integrated interface allowing users to easily build programs using four programming languages: relay ladder, structured text, sequential function chart, and function block diagram. The software allows students to concentrate on the logic aspects of PLC programming instead of spending time on complex syntax. It also features drag-and-drop editing, search-and-replace functions, and tools for verifying programs before running them on a PLC. Studio 5000 Logix Designer can be used to program a PLC via the built-in RS-232 port or via an Ethernet link. The software comes with RSLinx lite which provides the functionality required to support RSLogix and RSNetWorx.

The following versions are available:

- 5935-0: Studio 5000 Logix Designer Lite Edition (Educationnal)
- 5935-A: Studio 5000 Logix Designer Lite Edition (Commercial)
- 5935-1: Studio 5000 Logix Designer Full Edition (Educationnal)
- 5935-B: Studio 5000 Logix Designer Full Edition (Commercial)

Specifications

Parameter	Value
Included Software	RSLogix 5000 and RSLinx Lite
Available Languages	Relay Ladder, structured text, sequential function chart, and function block diagram.
Computer Requirements	Pentium IV 2.8 GHz, 1 GB of RAM, at least 16 GB of free hard disk space, and a 1024 x 768 True Color graphics device. Recommended: Intel i5 2.4 GHz processor, 8 GB of RAM, 20 GB of free hard disk space, and DirectX 9 graphics device with WDDM 1.0 or higher. Compatible operating systems: Windows XP Professional with SP3, Windows 7 Professional (64-bit) with SP1 or Home Premium (64 or 32-bit) with SP1.

Studio 5000 Logix Designer Lite Edition (Commercial)
587892 (5935-A0)

Studio 5000 Logix Designer is a Windows-based application, produced by Rockwell Software™, used to build programs for CompactLogix PLCs.

Studio 5000 Logix Designer provides a powerful integrated interface allowing users to easily build programs using four programming languages: relay ladder, structured text, sequential function chart, and function block diagram. The software allows students to concentrate on the logic aspects of PLC programming instead of spending time on complex syntax. It also features drag-and-drop editing, search-and-replace functions, and tools for verifying programs before running them on a PLC. Studio 5000 Logix Designer can be used to program a PLC via the built-in RS-232 port or via an Ethernet link. The software comes with RSLinx lite which provides the functionality required to support RSLogix and RSNetWorx.

The following versions are available:

- 5935-0: Studio 5000 Logix Designer Lite Edition (Educationnal)
- 5935-A: Studio 5000 Logix Designer Lite Edition (Commercial)
- 5935-1: Studio 5000 Logix Designer Full Edition (Educationnal)
- 5935-B: Studio 5000 Logix Designer Full Edition (Commercial)

Specifications

Parameter	Value
Included Software	RSLogix 5000 and RSLinx Lite
Available Languages	Relay ladder, structured text, sequential function chart, and function block diagram.
Computer Requirements	A currently available personal computer running under one of the following operating systems: Windows® 7 or Windows® 8.

I/O Interface with LVProSim
763509 (9065-B0)

The I/O Interface is a module used to interface with a computer for data acquisition and PID control of a real process. The I/O Interface provides interconnection between the process devices and the computer. It performs analog signal and digital signal conversions and sends the information to LVProSim, a process control software included with the interface.

The I/O Interface has four 4-20 mA analog inputs, two 4-20 mA analog outputs, four 24 V digital inputs, and two 24 V digital outputs. It connects to a computer through a USB cable and must be powered using a 24 V dc power supply.

The I/O Interface requires LVProSim, a process control software specially designed to connect to the interface and collect data at a fast sampling rate (100 ms). LVProSim has two main features: it can operate as a process controller and a

generic process simulator. LVProSim's modern web interface makes it easy to use, helping students focus on learning process control.

When used as a controller, LVProSim monitors data from the I/O Interface and applies a standard PID algorithm to determine the appropriate response. LVProSim can either control two processes simultaneously or use its two controllers in cascade mode. LVProSim also offers a set of mathematical functions to treat inputs and outputs signals.

The simulation mode allows students to model first-order or second-order processes. This mode encourages students to explore the various characteristics of a process such as its time constants, gain, and dead time. Once a generic process simulation is running, students can connect the simulated process to a controller and test different control schemes. Contrary to the data acquisition mode, the simulation mode does not require the I/O Interface. Therefore, students can experiment with the software on their own computer.

Note that, although the I/O interface is designed to be used with LVProSim, its data acquisition interface is compatible with Linux®, MATLAB®, and NI LabVIEW™. Raw data can be acquired using these software/platform, given the appropriate drivers are installed.

PID Controller
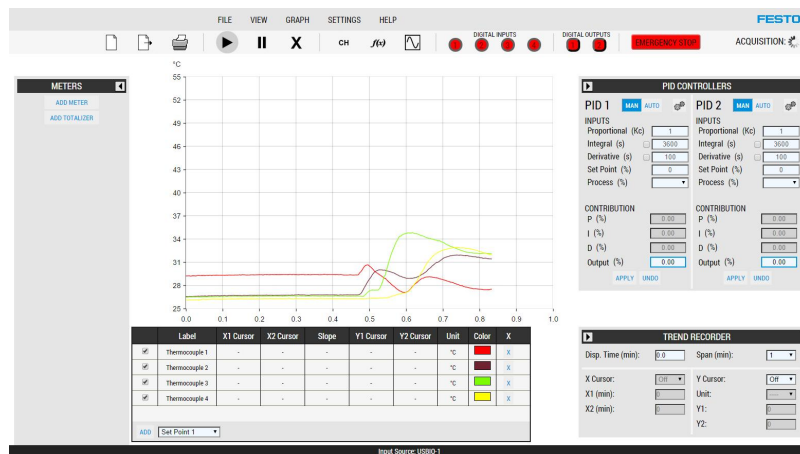
LVProSim uses a non-interacting ideal algorithm to control processes. Two controllers are available. They can be used to control two independent processes or they can be coupled via a dynamic set point for cascade control. The sampling interval and the controller action (director or reverse) are user selectable. A square-root extracting function permits linearization of measured signals and other mathematical functions are available as well.

The proportional (P), integral (I), and derivative (D) contributions on the final controller output can be displayed independently on the trend recorder. Meters can be added to the interface to display monitored variables in real time.

Trend Recorder

The LVProSim trend recorder can be used to plot different variables such as the set points, output signals, signals from the proportional, integral, and derivative contributions, measured and controlled variables, the function generator output signal, etc. A pause button can be used to stop the recorder at any time. The trend recorder can be scrolled backward and forward in time, with automatic time tracking during scrolling. Data can be exported to CSV format to be later imported into a spreadsheet software for detailed analysis and accurate measurement of the process characteristics.

Function Generator
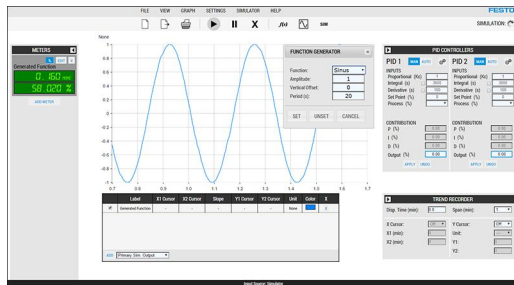
The function generator can produce a sine, square, triangle, or step signal. The signal from the function generator can be used as the controller set point or to perform manual control of a process device. When using LVProSim in the simulation mode, the generator signal can be used as the controller set point, the disturbance signal, or the controller output signal.
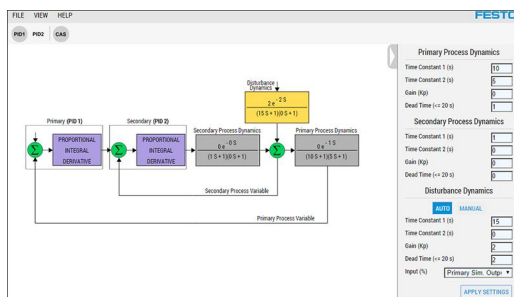
Data Acquisition

Through continuous acquisition of process data via the I/O Interface, LVProSim can:

- achieve digital PID control of the process
- be used as the primary and secondary controller of a cascade control loop
- be used as a process simulator
- be used as a general purpose data acquisition system

Generic Process Simulator

The generic process simulator provides simplified simulation to introduce basic concepts of process control. The simulator can be configured as first or second order process, with or without dead time. The disturbance can be configured as first order. The process and disturbance have variable gains.

Specifications

Parameter	Value
Supply Voltage	24 V
Inputs	
Analog	4 x 4-20 mA
Digital	4 x 24 V
Outputs	
Analog	2 x 4-20 mA
Digital	2 x 24 V
Analog/Digital Converter	
Resolution	12 bits
Digital/Analog Converter	
Resolution	8 bits
Relay	
Quantity	2
Current	1 A
Voltage	30 V DC

Parameter	Value
Computer Requirements	A currently available personal computer with USB 2.0 or 3.0 port, running under one of the following operating systems: Windows® 7, Windows® 8 or Windows® 10 .
Physical Characteristics	
Dimensions (H x W x D)	55 x 120 x 172 mm (2.2 x 4.7 x 6.8 in)
Net Weight	1 kg (2.2 lb)

Digital Pressure Gauge (High Range)
582387 (46761-B0)
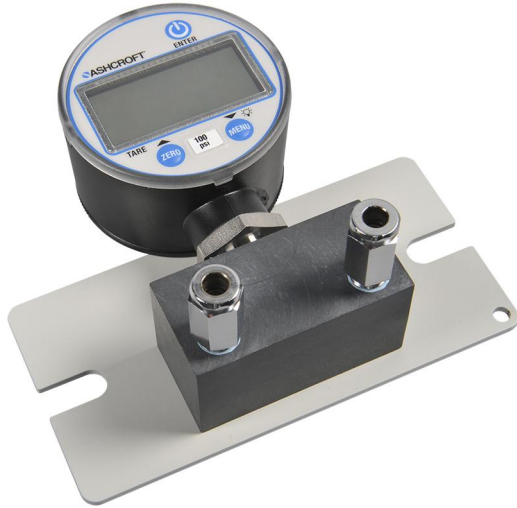
The Digital Pressure Gauge provides a direct reading of the pressure in one of many convenient measurement units. It features two interconnected pressure ports, an LCD display, and is equipped with a mounting bracket for simple installation on the workstation. The pressure gauge is available in two versions with different operating ranges:

46761-B High-Range – 0-100 psi (0-690 kPa)
46761-C Low-Range – 0-30 psi (0-200 kPa)

Process Workstation (Temperature, Pressure, Flow, and Level)
582388 (46801-E0)

The Process Workstation is the backbone of the system on which the processes take place. It consists of a double-sided mobile workstation comprising two 60 L (16 gal) tanks and four centrifugal pumps. This fully equipped version makes it possible to perform experiments with temperature, pressure, flow, and level processes. Two groups of students can work on the system at the same time, one group on each side. The steel frame of the Process Workstation ensures reliability and longevity of the system. The Process Workstation is delivered partly-assembled and requires assembling before use. The station is mounted on lockable casters to facilitate its mobility.

Process Workstation (Pressure, Flow, and Level)
582390 (46801-F0)

This version of the Process Workstation consists of a double-sided mobile workstation comprising two 60-liter (16 gal) tanks and a single centrifugal pump. It is designed for pressure, flow, and level processes, but can be upgraded for temperature processes with the proper add-ons. Two groups of students can work on the system at the same time, one group on each side. The steel frame of the Process Workstation ensures reliability and a long lifetime to the system.

The Process Workstation is delivered partly-assembled and requires assembling before use. The station is mounted on lockable casters to facilitate its mobility.

Instrumentation Workstation (With Heating/Cooling Unit)
582391 (46900-D0)

The Instrumentation Workstation is designed to house the Electrical Unit, the Pneumatic Unit, as well as all other electrical components that are not measuring instruments. Devices such as controllers, PLCs, Color Paperless Recorders, and Touch Screen Graphic Terminals must be installed on the Instrumentation Workstation. This prevents the equipment from coming in contact with water.

The Process Workstation, Model 46900-D, includes a Heating/Cooling Unit (Model 46908) which is required for temperature processes.

Like the Process Workstation, the Instrumentation Workstation is a double-sided mobile workstation. Two groups of students can work on the system at the same time, one group on each side.

Instrumentation Workstation (Assembled)
588306 (46900-G0)

The Instrumentation Workstation is designed to house the Electrical Unit, the Pneumatic Unit, as well as all other electrical components that are not measuring instruments. Devices such as controllers, PLCs, Color Paperless Recorders, and Touch Screen Graphic Terminals must be installed on the Instrumentation Workstation. This prevents the equipment from coming in contact with water.

The Instrumentation Workstation, Model 46900-G, does not include a Heating/Cooling Unit and is delivered already assembled.

Like the Process Workstation, the Instrumentation Workstation is a double-sided mobile workstation. Two groups of students can work on the system at the same time, one group on each side.

A hitch mechanism used to link the Instrumentation Workstation to the Process Workstation is part of the Piping and Accessories kit, Model 46993-C. This convenient piece of equipment makes it possible to move both stations as a single unit.

Column (Large Diameter)
582394 (46901-00)

The Column (Large Diameter) is a large watertight process column made of clear acrylic plastic. It comprises three ports at the top and bottom of the column which can be connected to the process loop or sealed off with a cap. A ruler is affixed to the column to make simple visual measurements of the level of liquid inside the column. Pressure ports allow for the measurement of the pressure at the bottom and at the top of the column. A safety valve is installed at the top of the column to prevent the pressure from exceeding a safe limit.

The column features an industrial flange that can house one of many optional level sensors and it contains a stainless steel baffle plate to reduce turbulence at the bottom water intake. It comes equipped with a bubbler tube to infer the level of fluid in the column. The column can also accommodate a variety of sensors inserted at its base.

Specifications

Parameter	Value
Capacity	30.4 L (8.025 gal)
Safety Valve	
Range	240-345 kPa (35-50 psi)
Physical Characteristics	
Height	93.7 cm (36.9 in)

Parameter	Value
Inner Diameter	20.3 cm (8 in)
Weight	TBE

Column (Small Diameter)
582395 (46902-00)

The Column (Small Diameter) is a watertight process column made of clear PVC with a capacity of 7.6 liters (2.0 gal). It has an inner diameter of 10.16 cm (4 in) and a height of 93.7 cm (36.9 in).

The column comprises two ports at the top and bottom of the column which can be connected to the process loop or sealed off with a cap. A ruler is affixed to the column to make simple visual measurements of the level of liquid inside the column. Pressure ports allow for the measurement of the pressure at the bottom and at the top of the column. A safety valve is installed at the top of the column to prevent the pressure from exceeding a safe limit. The safety valve starts to open at 240 kPa (35 psi) to relieve excess pressure and is fully open at a pressure of 345 kPa (50 psi).

The column features a bubbler tube to infer the level of fluid in the column and contains a stainless steel baffle plate to reduce water turbulence when it is filled from the bottom. The Column (Small Diameter) can be used to create interacting second-order processes when interconnected to the large diameter column.

Upper Tank
588307 (46903-00)

The Upper Tank is a tank made of heavy-duty polyethylene. The Upper Tank is used to create non-interacting second-order processes and is designed to be installed on the top of the Process Workstation. It features a total of five connection ports.

Specifications

Parameter	Value
Capacity	26.5 L (7 gal)
Physical Characteristics	
Dimensions (H x W x D)	TBE
Net Weight	TBE

Pumps Add-On (Temperature)
582396 (46904-A0)
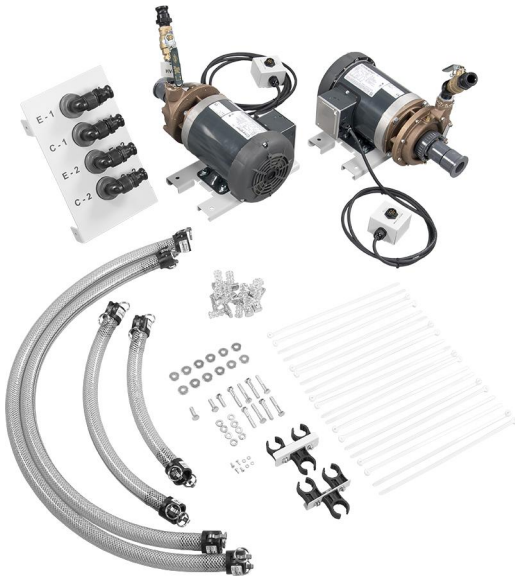
The Pumps Add-on consists of two additional pumps used to circulate the warm and cold water to the Heating/Cooling Unit while performing temperature process experiments. The pumps are similar to the one already installed and each one requires a drive to be operated (Model 46975).

This model includes the tubing and equipment required to install the pumps on the Process Workstation and to connect them to the system.

2nd Pump Add-On
582398 (46904-B0)
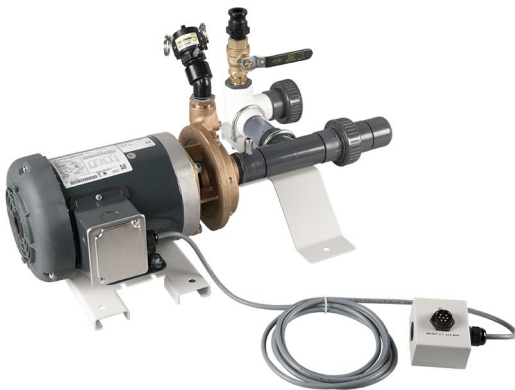
The Pumping Unit (Add-on) consists of a single additional pump to be used by a second team or to drain a Process Column in advanced control experiments. The pump is similar to the one already installed and requires a drive to be operated (Model 46975).

This model includes the tubing and equipment required to install the pump on the Process Workstation and to connect it to the system.

Brazed Plate Heat Exchanger
582400 (46905-00)

The Brazed Plate Heat Exchanger is designed to transfer heat from a warm fluid to a cold one. It is the default heat exchanger in the Pressure, Flow, Level, and Temperature Process Training Systems, but other optional models are available to introduce students to the different characteristics of each one.

The Brazed Plate Heat Exchanger is a compact type of exchanger made of a series of thin, usually corrugated plates which, once joined, are designed to create cavities in which the process fluids flow. Each plate has four corner ports (one inlet, and one outlet for each of the two fluids). When the plates are assembled, the ports line up to give access to the cavities. For each cavity, a pair of gaskets or restrictions alternately blocks

the access to one of the two fluids and lets the other one flow from the inlet to the outlet. The alternating layers of cold and warm fluids separated by a thin and thermally conductive wall allow for a very good heat transfer between the fluids.

Available optional heat exchangers:

- 46905-A Gasketed Plate Heat Exchanger

- 46905-B Shell and Tube Heat Exchanger (1 pass)

- 46905-C Shell and Tube Heat Exchanger (4 pass)

Air Tank (Large)
588312 (46906-00)

This Air Tank is a robust ASME-compliant pressure vessel designed to contain pressurized air. It features two pressure ports equipped with a quick-connect fitting (1/4 inch) and a graduated hand-operated valve.

Specifications

Parameter	Value
Capacity	7.6 L (2 gal)
Maximum Pressure	10.34 bar (150 psi)

Air Tank (Small)
588313 (46906-A0)

This Air Tank is a robust pressure vessel designed to contain pressurized air. It features two pressure ports each equipped with a quick-connect fitting (1/4 inch) and a graduated hand-operated valve. The tank is coated to resist corrosion and is tested to SAE J10 compliance.

Specifications

Parameter	Value
Capacity	0.95 L (1/4 gal)
Maximum Pressure	10.34 bar (150 psi)

Muffler Assembly
588314 (46907-00)
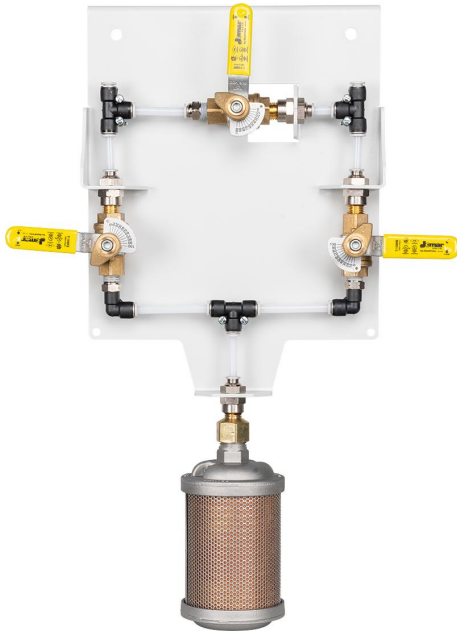
The Muffler Assembly is composed of two air inlet ports connected to a muffler to reduce exhaust noise. A graduated hand valve for each air inlet restricts the access to the muffler while a third one is used to link the two input lines.

Heating/Cooling Unit
763447 (46908-00)

The Heating/Cooling Unit warms the contents of one of the two water tanks of the Process Workstation while it cools the contents of the other one. This creates and maintains the temperature differential required for heat transfer experiments. The Heating/Cooling Unit is designed with enough capacity to insure efficient and continuous operation. The typical capacity of the Heating/Cooling Unit is 2 tons, 24000 BTU/hour, or 7 kW.

Rotameter
582402 (46910-00)

The Rotameter is a variable area flowmeter calibrated to measure the flow of water in the process loop. It provides a direct visual reading of the flow rate by observing the position of the float inside the transparent graduated tube.

Venturi Tube
582403 (46911-00)
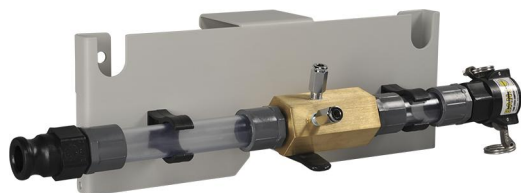
The Venturi Tube is a flow measurement device which relies on the Venturi effect to produce a pressure drop from which the flow rate can be inferred. This apparatus provides a clear picture of the phenomena and offers a low permanent pressure-loss.

The Venturi Tube requires the use of a differential-pressure transmitter to transform the pressure drop into a usable flow rate value.

Orifice Plate
588315 (46912-00)
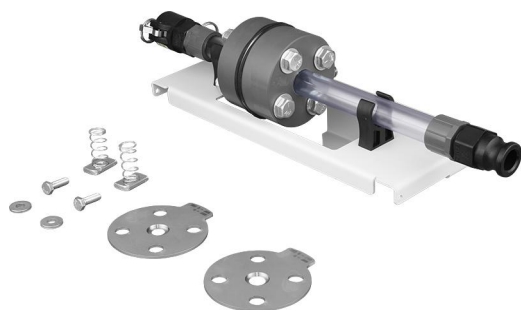
The Orifice Plate is a flow measurement device using the Venturi effect to produce a pressure drop from which the flow rate can be inferred. This primary element consists of a thin metal plate with a sharp-edged upstream aperture (orifice) inserted between two flanges at the location where the flow must be determined. This model is provided with three different plates.

The Orifice Plate requires the use of a differential-pressure transmitter to transform the pressure drop into a usable flow rate value.

List of Manuals

Description	Manual number
Flow Primary Elements (Workbook) _____	585135 (85996-00)

Description	Manual number

Table of Contents of the Manual(s)

Flow Primary Elements (Workbook) (585135 (85996-00))

- 1 Orifice Plate
- 2 Pitot Tube

Orifice Plate (Air- High Flow)
582404 (46914-00)
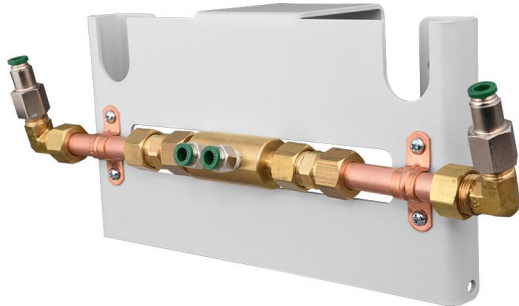
The Orifice Plate (Air - High Flow) is a flow measurement device designed for air applications. It uses the Venturi effect to produce a pressure drop from which the flow rate can be inferred. This primary element consists of an orifice precisely machined in a brass tube. The Orifice Plate requires the use of a differential-pressure transmitter to directly convert the pressure drop into a usable flow rate value.

Rotameter (Air)
582405 (46915-00)

The Rotameter is a variable area flowmeter specifically calibrated to measure the air flow in a compressed air setup. It provides a direct visual reading of the flow by simply observing the position of a float inside the transparent graduated tube.

J-Type Thermocouple
582406 (46916-00)

The J-Type Thermocouple uses the thermoelectric effect to perform precise measurement of temperature. The model is provided with a T-shaped connector and a thermowell for inclusion in the process loop.

Platinum RTD 100
582407 (46917-00)
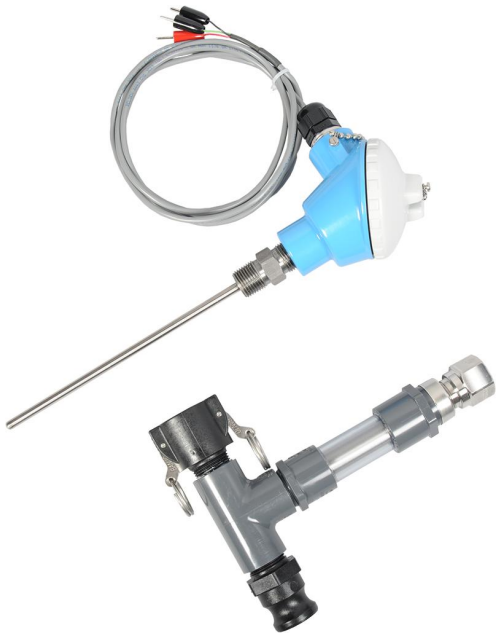
The Platinum RTD 100 is a resistive thermal device which uses the change of electrical resistance of platinum with changing temperature to determine the temperature. The model is provided with a T-shaped connector and a thermowell for inclusion in the process loop.

Differential-Pressure Transmitter (HART, High Range)
582408 (46920-00)

A differential pressure transmitter is an instrument that senses a pressure difference between two points and converts the pressure to a standardized electronic signal which can be sent to a control element. The transmitter can be configured so that its signal is either proportional to a pressure differential, a flow rate, or a level.

The High Range version of the differential pressure transmitter is designed to operate in a range going from a difference of 0 kPa (0 psi) to an absolute difference of 1.6 MPa (240 psi).

This Differential-Pressure Transmitter includes a transmitter which is compatible with the HART communication protocol.

Differential-Pressure Transmitter (HART, Low Range)
582410 (46921-00)

A differential pressure transmitter is an instrument that senses a pressure difference between two points and converts the pressure to a standardized electronic signal which can be sent to a control element. The transmitter can be configured so that its signal is either proportional to a pressure differential, a flow rate, or a level.

The Low Range version of the differential pressure transmitter is designed to operate in a range going from a difference of 0 kPa (0 psi) to an absolute difference of 50 kPa (7.3 psi).

This Differential-Pressure Transmitter includes a transmitter which is compatible with the HART communication protocol.

Electromagnetic Flow Transmitter (HART, Transmitter on the right)
582413 (46922-00)

The Electromagnetic Flow Transmitter is a flow measurement device relying on the conductive properties of liquids traveling across a magnetic field to measure the flow in a pipe. The operating principle of the flowmeter makes it insensitive to vibrations and causes almost no pressure loss. Temperature variations of the fluid are automatically compensated by the device for accurate flow rate measurement.

Due to the specific geometrical design of the apparatus, a different model (46922-1, -5, or -F) must be used if the Electromagnetic Flow Transmitter is to be installed on the second team side of the Process Workstation.

Available Electromagnetic Flow Transmitters:

- 46922-0 Electromagnetic Flow Transmitter (HART, Transmitter on the right)

- 46922-1 Electromagnetic Flow Transmitter (HART, Transmitter on the left)

- 46922-4 Electromagnetic Flow Transmitter (WLAN, Heartbeat, HART, Transmitter on the right)

- 46922-5 Electromagnetic Flow Transmitter (WLAN, Heartbeat, HART, Transmitter on the left)

- 46922-E Electromagnetic Flow Transmitter (Ethernet, Transmitter on the right)

- 46922-F Electromagnetic Flow Transmitter (Ethernet, Transmitter on the left)

List of Manuals

Description	Manual number
Electromagnetic Flow Meters (Workbook) _____	585123 (85990-00)
Electromagnetic Flow Meters (Workbook (Instructor)) _____	585126 (85990-10)

Table of Contents of the Manual(s)

Electromagnetic Flow Meters (Workbook) (585123 (85990-00))
- 1 Fundamentals of the Electromagnetic Flowmeters

Electromagnetic Flow Transmitter (HART, Transmitter on the right)
582419 (46922-10)

The Electromagnetic Flow Transmitter is a flow measurement device relying on the conductive properties of liquids traveling across a magnetic field to measure the flow in a pipe. The operating principle of the flowmeter makes it insensitive to vibrations and causes almost no pressure loss. Temperature variations of the fluid are automatically compensated by the device for accurate flow rate measurement.

Due to the specific geometrical design of the apparatus, a different model (46922-1, -5, or -F) must be used if the Electromagnetic Flow Transmitter is to be installed on the second team side of the Process Workstation.

Available Electromagnetic Flow Transmitters:

- 46922-0 Electromagnetic Flow Transmitter (HART, Transmitter on the right)

- 46922-1 Electromagnetic Flow Transmitter (HART, Transmitter on the left)

- 46922-4 Electromagnetic Flow Transmitter (WLAN, Heartbeat, HART, Transmitter on the right)

- 46922-5 Electromagnetic Flow Transmitter (WLAN, Heartbeat, HART, Transmitter on the left)

- 46922-E Electromagnetic Flow Transmitter (Ethernet, Transmitter on the right)

- 46922-F Electromagnetic Flow Transmitter (Ethernet, Transmitter on the left)

List of Manuals

Description	Manual number
Electromagnetic Flow Meters (Workbook) _____	585123 (85990-00)
Electromagnetic Flow Meters (Workbook (Instructor)) _____	585126 (85990-10)

Table of Contents of the Manual(s)

Electromagnetic Flow Meters (Workbook) (585123 (85990-00))
- 1 Fundamentals of the Electromagnetic Flowmeters

Temperature Transmitter (HART)
582422 (46940-00)

The Temperature Transmitter displays the temperature measured by up to two devices such as RTDs or thermocouples. It also outputs either a 4-20 mA signal compatible with the HART communication protocol or a FOUNDATION Fieldbus communication signal. The configuration of this transmitter can only be modified using the Software Configurator, Model 46982.

Available Temperature Transmitters:

- 46940-0 Temperature Transmitter (HART)

- 46940-A Temperature Transmitter (FOUNDATION Fieldbus)

Pneumatic Control Valve
582424 (46950-B0)

The Pneumatic Control Valve is an industrial bronze control globe valve designed for pressure, flow, level, and temperature control applications. This reliable valve features a durable construction, tight shutoff, and good control characteristics. The valve is of the equal percentage type and is normally open.

This model includes a current-to-pressure converter which transforms a 4-20 mA input signal into a pneumatic output signal sent to the actuator of the control valve.

The Pneumatic Control Valve features a bypass that can be used to control the liquid flow manually.

Manual

Description	Manual number
Control Valves (User Guide)	585145 (86001-E0)

Table of Contents of the Manual(s)

Control Valves (User Guide) (585145 (86001-E0))

- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)
- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Specifications

Parameter	Value
Input Signal	4-20 mA
Actuator Pressure Range	20-90 kPa (3-13 psi)
Type of valve	Globe, equal percentage, normally open

Solenoid Valve
582426 (46951-00)
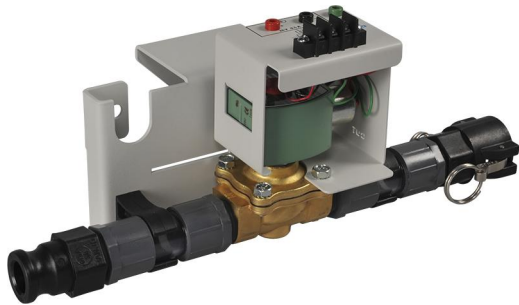
The Solenoid Valve is a simple unidirectional, direct-acting, normally closed valve made of brass which can be used to effect on/off control on a process. The Solenoid Valve fully opens when a 24 V dc signal is applied to the electrical connectors wired to the solenoid.

Solenoid Valve (Air)
582427 (46951-A0)

The Solenoid Valve (Air) is a four-way, two-position, single-solenoid operated, directional control valve. It is made of brass and has 1/4 inch connectors. The valve can be used, among other things, to direct the flow of air and to create perturbations in the system. A 24 V dc signal is used to toggle the position of the solenoid.

Ball Valve
588365 (46952-00)

The Ball Valve is a versatile brass hand valve used for on/off control of ports in the Pressure, Flow, Level, and Temperature Process Training Systems. It can also be used to throttle and manually regulate the flow in a process loop.

Pneumatic Control Valve (Air)
582428 (46953-00)

The Pneumatic Control Valve for Air is a normally closed stainless steel valve with 1/4 inch connectors designed to regulate the flow of air. This compact valve features a rugged construction and good control characteristics over the air flow. The Pneumatic Control Valve (Air) includes a current-to-pressure converter which transforms a 4-20 mA input signal into a pneumatic signal sent to the actuator of the valve.

This control valve is available in different versions which can include a positioner. The various versions are:

- 46953-00 Pneumatic Control Valve (Air)

- 46953-A0 Pneumatic Control Valve for Air with Digital Positioner (HART) - DVC 2000

- 46953-B0 Pneumatic Control Valve for Air with a Positioner - Fisher 3660

- 46953-C0 Pneumatic Control Valve for Air with Digital Positioner (HART) - DVC 6200

- 46953-D0 Pneumatic Control Valve for Air with Digital Positioner (FOUNDATION Fieldbus) - DVC 6200

Manual

| Description	Manual number
Control Valves (User Guide)	585145 (86001-E0)

Table of Contents of the Manual(s)

Control Valves (User Guide) (585145 (86001-E0))
- 1 Basic Control Valve Theory
- 2 Basic Control Valve (46950-B)
- 3 Pneumatic Control Valve with a Positioner (46950-A)
- 4 Control Valve with DVC2000 (46950-0)

- 5 Control Valve with DVC6000 – HART/FF (46950-E/-D)
- 6 Control Valve with DVC6200 – HART/FF (46950-E/-D)
- 7 Electric Control Valve (46950-C)

Three-Way Pneumatic Control Valve
582430 (46955-B0)

The Three-Way Control Valve is an industrial bronze control globe valve designed mainly for temperature control applications. This reliable valve features a durable construction, tight shutoff, and good control characteristics. The valve is designed to be used in mixing mode (two inlets, one outlet) and is of equalpercentage type. This valve is normally open on the lower port.

Like the Control Valve, Model 46950-X, this model has either a pneumatic or an electric actuator and may feature options such as a digital valve controller (either a DVC 2000 or a DVC 6000) supporting either HART or Fieldbus, or a pneumatic positioner. Refer to the description of the equivalent 46950-X model for more information.

Available Three-Way Control Valves:

- 46955-0 Three-Way Pneumatic Control Valve with Digital Positioner (HART) - DVC 2000

- 46955-A Three-Way Pneumatic Control Valve with Positioner (Fisher 3660)

- 46955-B Three-Way Pneumatic Control Valve

- 46955-C Three-Way Electric Control Valve

- 46955-D Three-Way Pneumatic Control Valve with Digital Positioner (FOUNDATION Fieldbus) - DVC 6000

- 46955-E Three-Way Pneumatic Control Valve with Digital Positioner (HART) - DVC 6000

Manual

Description	Manual number
Control Valves (User Guide)	585145 (86001-E0)

Table of Contents of the Manual(s)

Control Valves (User Guide) (585145 (86001-E0))

Programmable Logic Controller (S7-1516)
589671 (46962-00)
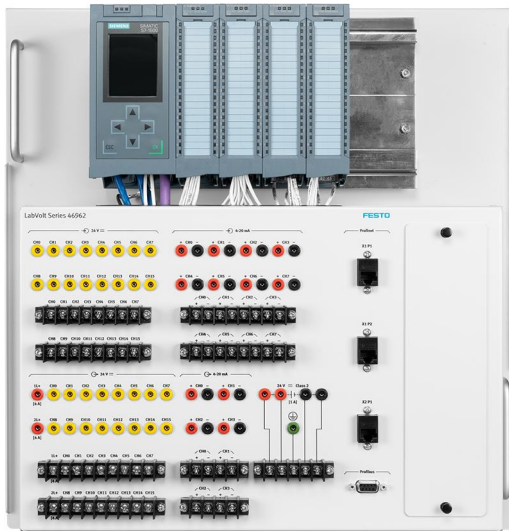
The Programmable Logic Controller (S7-1516) consists of a controller from the Siemens family. This powerful PLC comes with sixteen 24 V dc inputs, eight 4-20 mA inputs, eight 24 V dc output relays and eight 4-20 mA outputs hardwired to both banana jacks and terminal blocks on the module front panel. Banana jacks provide an easy and fast way to wire a setup, while terminal blocks allow students to wire their setup in a way much closer to what is commonly found in the industry.

The Siemens S7-1516 PLC supports two types of network communication: one PROFIBUS and three PROFINET ports.

The S7-1516 PLC is programmed using Siemens SIMANTIC STEP 7 Pro software in TIA Portal environnement (Model 46986) using any of four languages: Ladder (LAD), Function Block Diagram (FBD), Instruction List (IL). This module has ten switches that the instructor can use to insert faults.

Programmable Logic Controller (AB MicroLogix 1100)
588381 (46964-00)

The AB MicroLogix 1100 PLC is a compact programmable logic controller ideal for small to mid-sized applications. It features ten digital inputs, two analog inputs, six digital outputs, and two analog outputs. Programs for this PLC are written using Rockwell's RSLogix Micro software (Model 3245-A or -B) and can be used to implement a wide variety of control procedures, including PID routines.

It includes an Ethernet communication port, a DF1 Full-Duplex Serial link (RS-232-C) port, an embedded LCD and control keys, and many more advanced features. Hidden behind the module is a total of eight switches that the instructor can use to insert faults in the system.

Programmable Logic Controller (AB ControlLogix)
589122 (46965-10)

The Programmable Logic Controller (AB ControlLogix) consists of a controller from the Allen-Bradley family. This powerful PLC comes with sixteen 24 V dc inputs, eight 4-20 mA HART inputs, eight 24 V dc output relays and eight 4-20 mA HART outputs hardwired to both banana jacks and terminal blocks on the module front panel. Banana jacks provide an easy and fast way to wire a setup, while terminal blocks allow students to wire their setup in a way much closer to what is commonly found in the industry.

The ControlLogix PLC supports EtherNet/IP. The EtherNet/IP communication ports are located on the PLC processor. A USB port, also located on the PLC processor, can be used to transfer a program into the PLC.

The ControlLogix PLC can be programmed using Rockwell's RSLogix 5000 Full Edition software (Model 5935-1 or -B) in any of four languages: relay ladder, structured text, sequential function chart, and function block diagram. The module has ten switches that the instructor can use to insert faults.

Programmable Logic Controller (AB CompactLogix)
589123 (46966-10)

The AB CompactLogix PLC is a cost-effective controller from the Allen-Bradley family of Logix controllers. This PLC features a L24 CPU and includes sixteen 24 V dc digital inputs and sixteen 24 V dc digital output relays hardwired to both banana jacks and terminal blocks on the module front panel. Banana jacks provide an easy and fast way to wire a setup, while terminal blocks allow students to wire their setup in a way much closer to what is commonly found in the industry. A total of eight 4-20 mA analog inputs and eight 4-20 mA analog outputs are also included.

The CompactLogix PLC supports Ethernet/IP network communication. The two Ethernet/IP ports are located on the front panel to make the cabling more convenient.

The CompactLogix PLC is programmed with Rockwell's RSLogix 5000 Lite Edition software (Model 5935 or -A) using any of four languages: Relay ladder, structured text, sequential function chart, and function block diagram. This module has ten switches that the instructor can use to insert faults.

Electrical Unit
592680 (46970-10)

The Electrical Unit is the source of 24 V dc power for the system. It includes a lockable safety switch, a power transformer from line level to 24 V dc, and all the necessary inputs and outputs in both a banana jack version and in a terminal block version. A fault panel is also included to easily insert a fault during troubleshooting exercises.

Pneumatic Unit
582433 (46971-A0)

The Pneumatic Unit regulates the pressurized air coming from an external compressed air source. It includes an activation switch to quickly turn on or off the air supplied, an adjustable low-range pressure regulator (0 to 200 kPa (0 to 30 psi)) with its output air port, and an adjustable high-range pressure regulator (0 to 700 kPa (0 to 100 psi)) with its output air port. A fault panel is included to insert a fault in the system when performing troubleshooting exercises.

Specifications

Parameter	Value
Low-Range Pressure Regulator	
Range	0-200 kPa (0-30 psi)
High-Range Pressure Regulator	
Range	0-700 kPa (0-100 psi)
Physical Characteristics	
Dimensions (H x W x D)	TBE
Net Weight	TBE

Color Paperless Recorder
595185 (46972-A0)

The Color Paperless Recorder is a state-of-the-art device designed to acquire, display, record, and archive analog input signals. Four high-speed 4-20 mA inputs with a scan time of 100 ms are available and can be displayed on the thin-film-transistor (TFT) 17.8

cm (7 in) color display. The device can be configured using push-buttons and a shuttle dial, and it can be programmed to activate one of four output relays as required by the user. The data acquired can be recorded in the internal memory of the apparatus and it can also be transferred to a USB stick for archiving or transfer to a PC. An Ethernet port is available to include the recorder in a PC network (TCP/IP).

Energy Manager
582435 (46974-00)

The Energy Manager is a device used to record the temperatures measured at different points in the system. It can use the flow rate signals coming from optional transmitters to calculate energy balances in real time. The Energy Manager features an alphanumeric display with eight buttons and is powered by a 24 V dc signal. Up to four Platinum RTDs (Model 46917) can be connected to the inputs of the Energy Manager. Output relays and 4-20 mA outputs are also part of the device. The device can be programmed using a computer and a serial cable.

AC Variable Frequency Drive (Ethernet)
8122680 (46975-10)
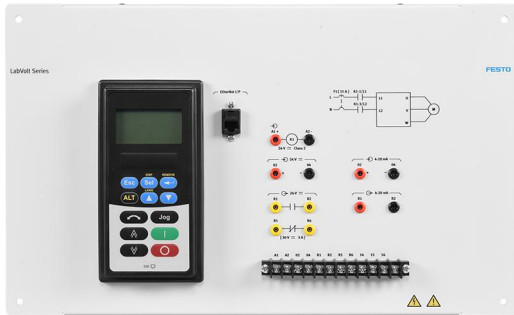
The AC Drive comprises an industrial Allen-Bradley Power Flex 525[®] 1.0-HP AC Drive used to control the pump(s) of the system. It features control inputs and outputs and can optionally communicate via an Ethernet link. The different versions of the AC Drives can be powered by either single-phase or three-phase power alimentation.

Three-Phase drives require an Electrical Distribution Box (model 46997) which can support up to four drives.

Available AC Drives:

- 46975-1 AC Drive (Ethernet) – Single-Phase AC Supply

- 46975-2 AC Drive (Ethernet) – Three-Phase AC Supply

AC Variable Frequency Drive (Ethernet)
8122682 (46975-20)
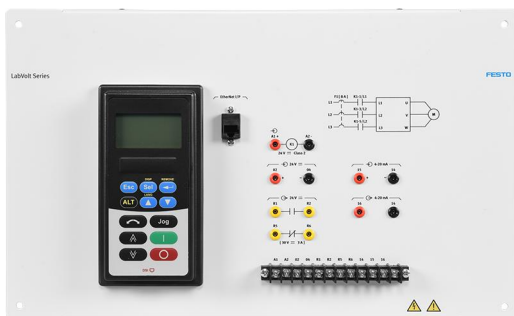
The AC Drive comprises an industrial Allen-Bradley Power Flex 525[®] 1.0-HP AC Drive used to control the pump(s) of the system. It features control inputs and outputs and can optionally communicate via an Ethernet link. The different versions of the AC Drives can be powered by either single-phase or three-phase power alimentation.

Three-Phase drives require an Electrical Distribution Box (model 46997) which can support up to four drives.

Available AC Drives:

- 46975-1 AC Drive (Ethernet) – Single-Phase AC Supply

- 46975-2 AC Drive (Ethernet) – Three-Phase AC Supply

AC Drive (Ethernet) - Single-Phase AC Supply
589673 (46975-E0)

The AC Drive comprises an industrial Siemens G120 1.0-HP AC Drive used to control the pump(s) of the system. It features control inputs and outputs and can optionally communicate via an PROFINET link..

The AC drive features four switches that permit the instructor to insert faults for troubleshooting exercises.

Distributed I/O Module (HART)
589674 (46976-00)

The Distributed I/O Module (ET 200M) consists of an interface module from Siemens and permits to connect analog I/O's using HART communication protocol to a Siemens PLC through PROFINET communication. This I/O module features eight 4-20 mA HART analog inputs and eight 4-20 mA HART analog outputs.

All the I/O'S can be hardwired to both banana jacks and terminal blocks on the module front panel. Banana jacks provide an easy and fast way to wire a setup, while terminal blocks allow students to wire their setup in a way much closer to what is commonly found in the industry.

This module has six switches that the instructor can use to insert faults.

TIA Portal PLC Software (Step 7 Professional) with Process Device Manager (PDM)
589676 (46986-00)

The TIA Portal PLC Software (Step 7 Professional) is a programming software that is required for programming Siemens programmable logic controllers. Model 46986-0 also includes SIMATIC PDM (Process Device Manager) software for configuration, parameter assignment, commissioning, diagnostics and maintenance of intelligent field devices and automation components.
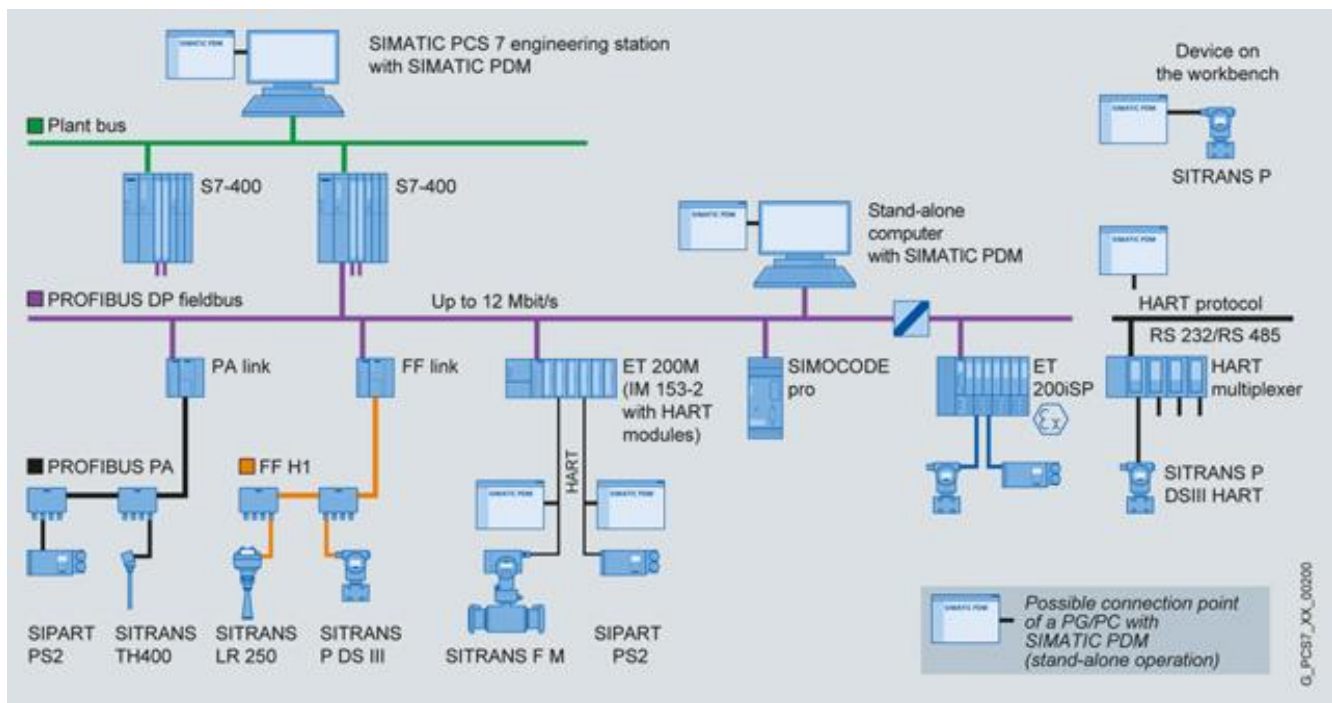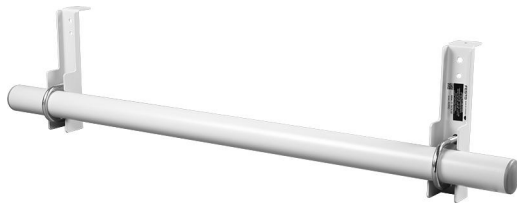
TIA Portal PLC Software (Step 7 Professional)
592687 (46986-10)

The TIA Portal PLC Software (Step 7 Professional) is a programming software that is required for programming Siemens programmable logic controllers.

Instrumentation Mounting Pipe
582444 (46990-00)

The Instrumentation Mounting Pipe is a vertical pipe used to install instruments, usually differential-pressure transmitters, at the appropriate height and close to the point of measurement. The mounting pipe replicates the common industrial practice of installing a measuring instrument directly on the process pipe or on an adjacent one. The Instrumentation Mounting Pipe can be mounted on both sides of the Process Workstation or on the Instrumentation Workstation.

Process Supports (Pressure/Flow/Level/Temperature)
582445 (46991-C0)

The Process Supports models are packages containing a subset of the following elements: various process struts, a storage rack to store up to four optional flange tops, a long wire duct, a hose storage rack, and other assorted items.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment such as the storage rack.

Available Process Supports:

- 46991-C Process Supports (Pressure/Flow/Level/Temperature)

- 46991-D Process Supports (Temperature)

- 46991-E Process Supports (Pressure/Flow/Level) - Add-on

- 46991-G Process Supports (Pressure/Flow/Level) - Add-on for 2nd team

Process Supports (Temperature)
582446 (46991-D0)

The Process Supports models are packages containing a subset of the following elements: various process struts, a storage rack to store up to four optional flange tops, a long wire duct, a hose storage rack, and other assorted items.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment such as the storage rack.

Available Process Supports:

- 46991-C Process Supports (Pressure/Flow/Level/Temperature)

- 46991-D Process Supports (Temperature)

- 46991-E Process Supports (Pressure/Flow/Level) - Add-on

- 46991-G Process Supports (Pressure/Flow/Level) - Add-on for 2nd team

Process Supports (Pressure/Flow/Level) - Add-on
### 588425 (46991-E0)

The Process Supports models are packages containing a subset of the following elements: various process struts, a storage rack to store up to four optional flange tops, a long wire duct, a hose storage rack, and other assorted items.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment such as the storage rack.

Available Process Supports:

- 46991-C Process Supports (Pressure/Flow/Level/Temperature)
- 46991-D Process Supports (Temperature)
- 46991-E Process Supports (Pressure/Flow/Level) - Add-on

- 46991-G Process Supports (Pressure/Flow/Level) - Add-on for 2nd team

Process Supports (Pressure/Flow/Level) - Add-on, 2nd team
588427 (46991-G0)

The Process Supports models are packages containing a subset of the following elements: various process struts, a storage rack to store up to four optional flange tops, a long wire duct, a hose storage rack, and other assorted items.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment such as the storage rack.

Available Process Supports:

- 46991-C Process Supports (Pressure/Flow/Level/Temperature)
- 46991-D Process Supports (Temperature)
- 46991-E Process Supports (Pressure/Flow/Level) - Add-on
- 46991-G Process Supports (Pressure/Flow/Level) - Add-on for 2nd team

Drip Tray (Front)
582447 (46992-B0)
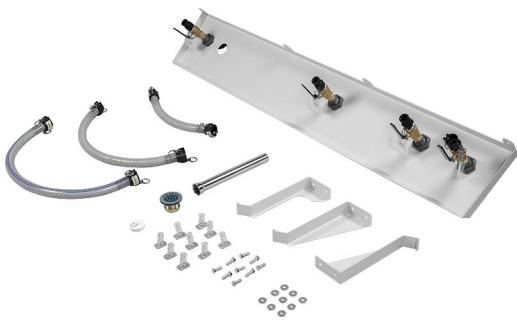
The Drip Tray is a package containing a large painted stainless steel drip tray to collect the water. A series of hand valves and a drain tube are also included, along with associated parts.

This model is available in two different versions: One for the front side of the workstation and one for the back side (Second team side).

Available versions:

- 46992-B Drip Tray (Front)

- 46992-C Drip Tray (Back)

Drip Tray (Back)
582448 (46992-C0)
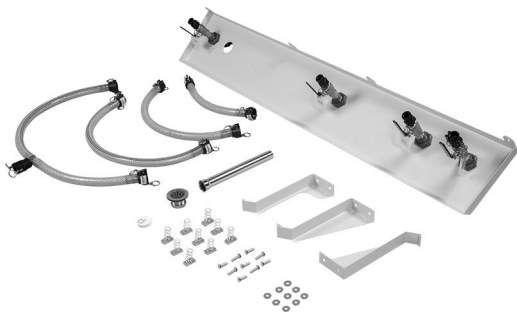
The Drip Tray is a package containing a large painted stainless steel drip tray to collect the water. A series of hand valves and a drain tube are also included, along with associated parts.

This model is available in two different versions: One for the front side of the workstation and one for the back side (Second team side).

Available versions:

- 46992-B Drip Tray (Front)

- 46992-C Drip Tray (Back)

Piping and Accessories - 2nd team
588429 (46993-A0)

The Piping and Accessories kit contains the components required to operate the Pressure, Flow, Level, and Temperature Process Training Systems and to perform the suggested experiments.

Among the components of this model are: a series of hoses, elbows, and pressure ports, a wet leg designed to perform experiments on the process column, a threevalve manifold, a small ladder, wires, pressure tubes, tools, and an attach bracket to link the Instrumentation Workstation to the Process Workstation.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment whenever appropriate.

Available kits:

- 46993-A: Piping and Accessories - 2nd Team
- 46993-C: Piping and Accessories (Temperature) - Basic System
- 46993-E: Piping and Accessories (Pressure/Flow/Level) - Basic System
- 46993-F: Piping and Accessories (Pressure/Flow/Level) - Add-on
- 46993-J: Piping and Accessories (Temperature) - Add-on

Piping and Accessories (Air)
588430 (46993-B0)

The Piping and Accessories (Air) model includes a reel of tubing, a tube cutter, connectors, and other items required to use the air workstation. A manual needle valve is also included to control the flow of air in the process.

Piping and Accessories (Temperature) - Basic System
582449 (46993-C0)

The Piping and Accessories kit contains the components required to operate the Pressure, Flow, Level, and Temperature Process Training Systems and to perform the suggested experiments.

Among the components of this model are: a series of hoses, elbows, and pressure ports, a wet leg designed to perform experiments on the process column, a threevalve manifold, a small ladder, wires, pressure tubes, tools, and an attach bracket to link the Instrumentation Workstation to the Process Workstation.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment whenever appropriate.

Available kits:

- 46993-A: Piping and Accessories - 2nd Team

- 46993-C: Piping and Accessories (Temperature) - Basic System

- 46993-E: Piping and Accessories (Pressure/Flow/Level) - Basic System

- 46993-F: Piping and Accessories (Pressure/Flow/Level) - Add-on

- 46993-J: Piping and Accessories (Temperature) - Add-on

Accessories (Temperature) - Advanced
582450 (46993-D0)

The Accessories (Temperature) - Advanced include an infrared thermometer and a reference manual.

Manual

Description	Manual number
Fundamentals of Heat Exchange (Workbook)	585230 (87205-00)

Piping and Accessories (Pressure/Flow/Level, Allen-Bradley) – Basic System
582451 (46993-E0)

The Piping and Accessories kit contains the components required to operate the Pressure, Flow, Level, and Temperature Process Training Systems and to perform the suggested experiments.
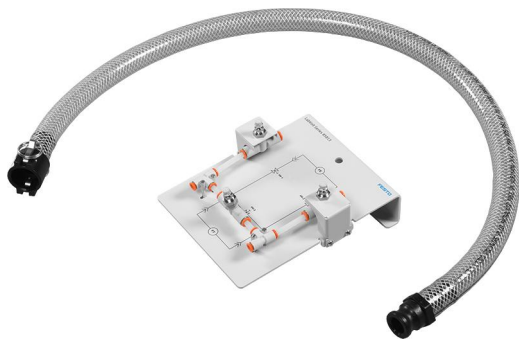
Among the components of this model are: a series of hoses, elbows, and pressure ports, a wet leg designed to perform experiments on the process column, a threevalve manifold, a small ladder, wires, pressure tubes, tools, and an attach bracket to link the Instrumentation Workstation to the Process Workstation.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment whenever appropriate.

Available kits:

- 46993-A: Piping and Accessories - 2nd Team

- 46993-C: Piping and Accessories (Temperature) - Basic System

- 46993-E: Piping and Accessories (Pressure/Flow/Level) - Basic System

- 46993-F: Piping and Accessories (Pressure/Flow/Level) - Add-on

- 46993-J: Piping and Accessories (Temperature) - Add-on

Piping and Accessories (Pressure/Flow/Level) - Add-on
588431 (46993-F0)

The Piping and Accessories kit contains the components required to operate the Pressure, Flow, Level, and Temperature Process Training Systems and to perform the suggested experiments.

Among the components of this model are: a series of hoses, elbows, and pressure ports, a wet leg designed to perform experiments on the process column, a threevalve manifold, a small ladder, wires, pressure tubes, tools, and an attach bracket to link the Instrumentation Workstation to the Process Workstation.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment whenever appropriate.

Available kits:

- • 46993-A: Piping and Accessories - 2nd Team
- • 46993-C: Piping and Accessories (Temperature) - Basic System
- • 46993-E: Piping and Accessories (Pressure/Flow/Level) - Basic System
- • 46993-F: Piping and Accessories (Pressure/Flow/Level) - Add-on
- • 46993-J: Piping and Accessories (Temperature) - Add-on

Piping and Accessories - Advanced
588432 (46993-G0)

The Piping and Accessories (Advanced) model includes a short hose and a three-valve manifold. This equipment is required for some of the advanced experiments on process control.

Piping and Accessories (Temperature) - Add-on
582452 (46993-J0)

The Piping and Accessories kit contains the components required to operate the Pressure, Flow, Level, and Temperature Process Training Systems and to perform the suggested experiments.

Among the components of this model are: a series of hoses, elbows, and pressure ports, a wet leg designed to perform experiments on the process column, a threevalve manifold, a small ladder, wires, pressure tubes, tools, and an attach bracket to link the Instrumentation Workstation to the Process Workstation.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment whenever appropriate.

Available kits:

- 46993-A: Piping and Accessories - 2nd Team

- 46993-C: Piping and Accessories (Temperature) - Basic System

- 46993-E: Piping and Accessories (Pressure/Flow/Level) - Basic System

- 46993-F: Piping and Accessories (Pressure/Flow/Level) - Add-on

- 46993-J: Piping and Accessories (Temperature) - Add-on

Piping and Accessories (Pressure/Flow/Level, Siemens) – Basic System
592689 (46993-N0)

The Piping and Accessories kit contains the components required to operate the Pressure, Flow, Level, and Temperature Process Training Systems and to perform the suggested experiments.

Among the components of this model are: a series of hoses, elbows, and pressure ports, a wet leg designed to perform experiments on the process column, a threevalve manifold, a small ladder, wires, pressure tubes, tools, and an attach bracket to link the Instrumentation Workstation to the Process Workstation.

The different variations are designed to account for the possibility of having two teams on the same station and to avoid redundancy of equipment whenever appropriate.

Electrical Distribution Box
582453 (46997-00)

The Electrical Distribution Box splits an input three-phase power signal into four output three-phase power signals in order to supply electricity to the AC Drives (Model 46975-C or -D) installed on the Instrumentation Workstation.

Optional Equipment Description

CompactLogix PLC Bundle – Educational (Optional)
588522 (3539-80)

This bundle includes a CompactLogix PLC, one copy of RSLogix 5000 Lite Edition, and a user guide.

Manual

Description	Manual number
ControlLogix and CompactLogix Programmable Logic Controllers (User Guide) _____	585159 (86030-E0)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

Specifications

Parameter	Value
Power Requirement	
Current	2.1 A
Inputs	
Analog (8)	4-20 mA analog inputs
Digital (16)	24 V dc contact inputs
Outputs	
Analog (8)	4-20 mA analog outputs
Digital (16)	24 V dc relays
Number of PID loops	8
Number of fault switches	10
Communication	Ethernet
Configuration	From a computer using RSLogix 5000

S7-1500 PLC Bundle HART – Educational (Optional)
589669 (3539-P0)

This bundle includes a Siemens S7-1500 PLC, a Distributed I/O Module (HART), one copy of STEP 7 Software, one copy of WinCC and one copy of the Process Device Manager Software.

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

S7-1500 PLC Bundle – Educational (Optional)
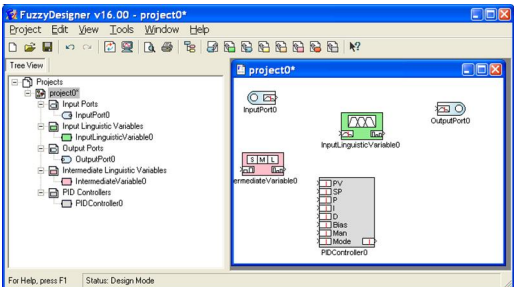## 589670 (3539-S0)

This bundle includes a Siemens S7-1500 PLC, one copy of STEP 7 and WinCC Software.

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Touch-Screen Computer – Large _____	589677 (46299-A0)

Fuzzy Logic Software Add-on to RSLogix 5000 (Educational) (Optional)
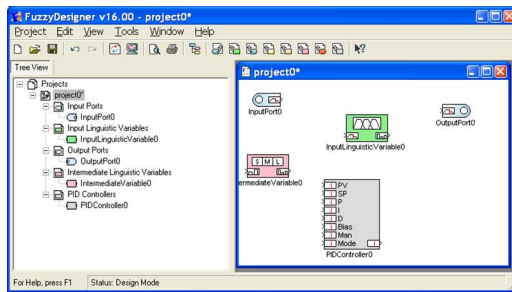## 587902 (5938-00)

The Fuzzy Logic Software Add-On features Fuzzy Designer, an add-on to RSLogix 5000 which lets the user design and implement fuzzy logic algorithms on a controller of the Logix 5000 family. Fuzzy Designer includes an extensive component library to help the user quickly build algorithms that can be used in any RSLogix 5000 program. Two variants are available:

- 5938-0 Fuzzy Logic Software Add-On (Educational)
- 5938-A Fuzzy Logic Software Add-On (Commercial)

Specifications

Parameter	Value
Computer Requirements	A currently available personal computer running under one of the following operating systems: Windows® 7 or Windows® 8.

Fuzzy Logic Software Add-on to RSLogix 5000 (Commercial) (Optional)
587903 (5938-A0)

The Fuzzy Logic Software Add-On features Fuzzy Designer, an add-on to RSLogix 5000 which lets the user design and implement fuzzy logic algorithms on a controller of the Logix 5000 family. Fuzzy Designer includes an extensive component library to help the user quickly build algorithms that can be used in any RSLogix 5000 program. Two variants are available:

5938-0 Fuzzy Logic Software Add-On (Educational)

- 5938-A Fuzzy Logic Software Add-On (Commercial)

Specifications

Parameter	Value
Computer Requirements	A currently available personal computer running under one of the following operating systems: Windows$^®$ 7 or Windows$^®$ 8.

Compressor (Optional)
588108 (6410-C0)

The Air Compressor is a quiet device well suited for classroom and school laboratories. The Air Compressor can be used to provide compressed air to different components. A conditioning unit, Model 6411-A, must be connected to the compressor for certain applications.

The Circulator Pump is available in different variants depending on ac power network voltages and frequencies. Because of this, the actual module may vary from the one shown in the picture.

Specifications

Parameter	Value
Power Requirements	
Current	4.8 A
Service Installation	Standard single-phase ac outlet
Tank Capacity	15.1 L (4 gal)
Flow Rate	42.5 L/min at 620 kPa (1.5 SCFM at 90 psi)
Maximum Pressure	800 kPa (120 psi)
Noise Level	40 dB(A) (about as quiet as a refrigerator)
Physical Characteristics	
Dimensions (H x W x D)	TBE
Net Weight	TBE

Touch-Screen Computer – Large (Optional)
589677 (46299-A0)

The Touch-Screen Computer is a solution for saving space in the classroom. It features a large 23-inch touch-screen and a high-speed processor. It can be installed on a full-motion mount, model 3451-A0 or 3451-B0, on the Instrumentation Workstation to maximize desk space.

Touch Screen Graphic Terminal (Allen-Bradley) - 26.4 cm (10.4 in) (Optional)
8103425 (46973-10)
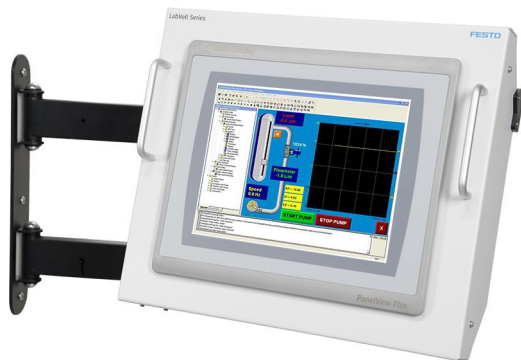
The Touch Screen Graphic Terminal consists of an Allen-Bradley PanelView™ Plus 7 1000 with a 26.4 cm (10.4 in) color display. This touch-screen interface allows monitoring and control of some features of the Pressure, Flow, Level, and Temperature Process Training Systems. The Touch Screen Graphic Terminal is pre-programmed with a control interface developed with the various components of the system in mind. It features an integrated EtherNet/IP communication port and one USB port. The Touch Panel requires a 24V-DC power supply that can be connected using either a terminal block or a M12 quick connector.

The FactoryTalk software is optional and can be used to design your own visualization and control interface or modify the interface developed for the Touch Screen Graphic Terminal.

Manual

Description	Manual number
Human-Machine Interfaces (User Guide)	585116 (85985-E0)

Industrial PC HMI (Siemens) (Optional)
589672 (46973-A0)

The Industrial PC HMI consists of a Siemens 477D Industrial PC with a 48.2 cm (19 in) color display. This touch-screen interface allows monitoring and control of some features of the Pressure, Flow, Level, and Temperature Process Training Systems. The Touch Screen Graphic Terminal is pre-programmed with a control interface developed with the various components of the system in mind. It features an integrated PROFINET communication port, three USB ports and DVI port to connect an extra large monitor for presenting démonstrations to a large student group. The Industrial PC includes Windows 7 Ultimate and WinCC Runtime software.

The WinCC Advanced development software, Model 46984, is optional and can be used to design your own control interface.

Manual

Description	Manual number
Human-Machine Interface (User Guide)	590101 (52601-E0)

Calibration Kit (Optional)
588416 (46980-00)

The Calibration Kit includes the equipment required to precisely adjust the control valves and to perform diagnostic tests on electrical devices. The kit contains a Fluke 725 multifunction process calibrator which can act as a source and measure different parameters. A calibration pump completes the kit and is used to calibrate pressure devices.

A Calibration Kit, Model 46980 or 46981, is required to characterize and tune processes in the Pressure, Flow, Level, and Temperature Process Training Systems.

Manual

Description	Manual number
(Workbook)	594085 (54387-00)

HART Software Configurator (Optional)
588420 (46982-00)

The Software Configurator includes the FieldCare software necessary to interpret the data related to the different smart devices and to configure their parameters. The HART version also includes a communication box for data transfer between a HART device and a PC with a USB port.

Available versions:

46982-0 HART Software Configurator
- 46982-A FOUNDATION Fieldbus Software Configurator
- 46982-B HART/FOUNDATION Fieldbus Software Configurator

List of Manuals

Description	Manual number
HART Device Configuration (Workbook)	585164 (86050-00)
HART Device Configuration (Workbook (Instructor))	585165 (86050-10)

Table of Contents of the Manual(s)

HART Device Configuration (Workbook) (585164 (86050-00))
- 2-1 Two-Wire Transmitter
- 2-2 Four-Wire Transmitter (Optional)
- 2-3 Output Device (Optional)
- 3-1 HART Multidrop with Multiple Transmitters

Specifications

Parameter	Value
Computer Requirements	A currently available personal computer running under one of the following operating systems: Windows® 7 or Windows® 8.

Step 7 professional and WinCC Advanced, 6 users (perpetual) + 20 Students (1 year), Educational (Optional)
8164650 (81646-50)

Trainer Package V17 STEP 7 Professional, Safety, WinCC Advanced and Unified Engineering

- STEP 7 Professional, Safety, WinCC Advanced and Unified Engineering, RT and Options, CFC, DCC, SiVArc, Test Suite, SIRIUS, Multiuser, Teamcenter Gateway, Cloud Connector; Target, ODK, PRODIAG, OPC UA, PLCSIM Advanced, Startdrive Advanced

- 6 x software license unlimited

- 20 x trial license for 365 days

- Software on DVD or Download

- License key on USB flash drive

- 9 languages: de,en,zh included, fr,es,it,ru,ja,ko as download

- Executable in Windows 10

- For configuring of SIMATIC S7- 1500/1200/300/400/WinAC, SIMATIC Panels

Technical changes are possible.

Special license rules apply for schools and educational institutes in the commercial sector.

Step 7 professional and WinCC Advanced, 20 Students (1 year), Educational (Optional)
8164652 (81646-52)

Trainer Package V17 STEP 7 Professional, Safety, WinCC Advanced and Unified Engineering

- STEP 7 Professional, Safety, WinCC Advanced and Unified Engineering, RT and options, CFC, Test Suite, Multiuser, PLCSIM Advanced, Target, ODK

- 20 x trial license for 365 days

- Software on DVD or Download

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- 9 languages: de,en,zh included, fr,es,it,ru,ja,ko as download

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- For configuring of SIMATIC S7- 1500/1200/300/400/WinAC, SIMATIC Panels

Technical changes are possible.

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