

S800 I/O

Product Guide

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Chapter 1 Overview

The S800 I/O is a distributed, highly modularized and flexible I/O-system with eco-efficient design, providing easy installation of the I/O modules, process cabling and connection to drives systems. The S800 I/O modules and termination units can be mounted and combined in many different configurations to fit your space requirements and suit many types of applications.

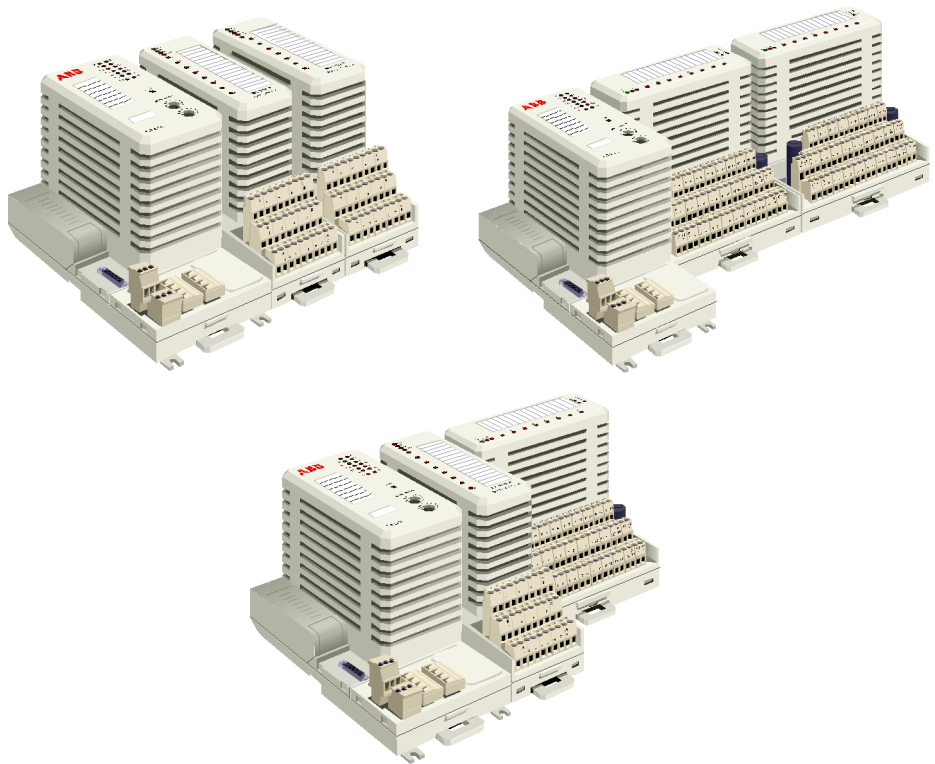


Figure 1-1. S800 I/O Fieldbus Communication Interface with I/O-modules on Compact and Extended MTUs

1.1 Product Benefits

Some of the benefits of the S800 I/O system are:

- Flexibility, permitting a virtually infinity number of installation arrangements
 - small to large
 - easy mounting on a DIN rail
 - etc.
- Modularity, permitting step-by-step expansion
- Cost-effectiveness, making you save on hardware, cabling, installation and maintenance
- Reliability and auto-diagnostics
- Saves panel costs
- Reduces down time
- Easy to configure.

1.2 Features

The major features of the S800 I/O system are:

- Communicates over PROFIBUS-DP or Advant Fieldbus 100
- Quick faultfinding with help of LEDs of each module and channel
- An extensive scope of Digital input/output modules and Analog input/output modules
- Digital input/output modules and Analog input/output modules with Intrinsic Safety interfaces
- Mounted on standard DIN rails
- Support of dual redundancy in power supply
- Support of fieldbus media supervision, bumpless change-over and failure reporting (Advant Fieldbus 100)

- All outputs can be individually set to freeze or to take on predefined values.
- Easy connection to drives systems, minimizing communication delays and cost.
- All modules have plastic injection molded enclosures which provide safety protection degree IP20 according to IEC 529.
The plastic used is halogen free.
- I/O modules are protected from destruction by a mechanical keying arrangement if an attempt is made to insert a module type in a position with a different key code than the factory set code of the I/O module. Terminal units have keys which are set to key code of its I/O module's key code.
(S800L I/O modules do not use Termination Units).
- An electrical ID is checked at start-up, if this does not match the configured type, the I/O module is not taken into operation.
- Hot-swap of S800M I/O modules allowing replacement of faulty modules without disconnecting field power or system power to the I/O-station.
(Do **not** hot-swap the S800L I/O modules.)
- I/O modules allow for 55°C ambient temperature except for vertical mounted Compact MTU with I/O modules allow for 40°C ambient temperature.
- Support of redundancy Advant Fieldbus 100 media.
- Support of redundancy Advant Fieldbus 100 interface units.
- Support of connection to external Intrinsic Safety Barriers.

Chapter 2 Functional Description

S800 I/O provides distributed I/O on PROFIBUS-DP and Advant Fieldbus 100 (AF100). S800 I/O is also used as a communication link to some of ABB's Drives.

Parameters for configuration are accessible over the fieldbus. Typical parameters are tag names, signal range, filter time, etc.

The status of the modules are indicated by LEDs and also accessible over the fieldbus. Analog values are scaled 0-100% of the signal range. AI/AO modules are scanned every 4th I/O scan cycle. RTD/TC every 10th cycle.

Values are transferred cyclically on the fieldbus limited by the fieldbus and the fieldbus master. The Fieldbus Communication Interface is scanning the I/O modules cyclically. The cycle time, 4 - 108 ms, is dependent on type and number of modules.

S800 I/O Station

An S800 I/O station includes:

- 1 or 2, if redundant Fieldbus Communication Interface (FCI)
- up to 24 S800 I/O modules divided into
 - 1 base cluster
 - up to 7 additional I/O clusters, each one containing up to 12 I/O modules.

Base Cluster

A base cluster includes:

- 1 or 2 (if redundancy) Fieldbus Communication Interfaces (FCI)
- up to 12 S800 I/O modules.

I/O Cluster

An I/O cluster includes:

- 1 optical Modulebus modem
- up to 12 S800 I/O modules.

I/O Modules

Any combination of I/O modules is possible, within the limits in Table 2-1.

Table 2-1. The max. I/O configuration of S800 I/O connected to Advant Fieldbus 100.

Item	Max. No.
S800 I/O stations per Advant Fieldbus 100	79 ⁽¹⁾
S800 I/O station per Profibus	99
S800 I/O modules per station connected via AF100	24 ⁽²⁾
S800 I/O modules per station connected via Profibus. Supported I/O modules types.	See Chapter 7, Technical Data and Performance

(1) If other than S800 I/O stations are used on the same Advant Fieldbus 100, the maximum number of S800 I/O stations must be reduced with a corresponding number of stations.

(2) Without Optical Modulebus Expansion the maximum number is 12.

2.1 Product Configuration Examples

To give you some ideas about the use of S800I/O, this chapter includes some basic configuration examples.

PROFIBUS-DP

An S800 I/O station can be connected to a PROFIBUS-DP network using the Fieldbus Communication Interface (FCI) CI830.

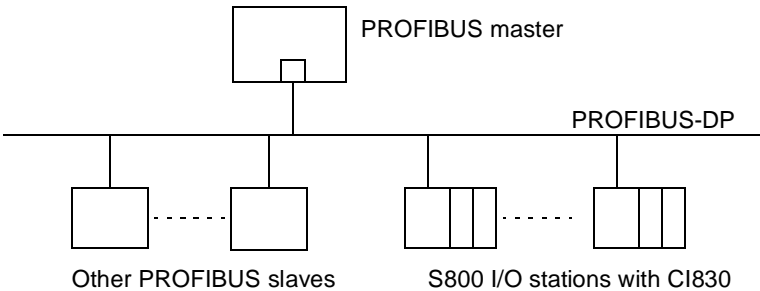


Figure 2-1. A PROFIBUS-DP configuration example

Advant Fieldbus 100 with or without media redundancy

Media redundancy on Advant Fieldbus 100 includes redundant cable and redundant modems and the CI810 FCI.

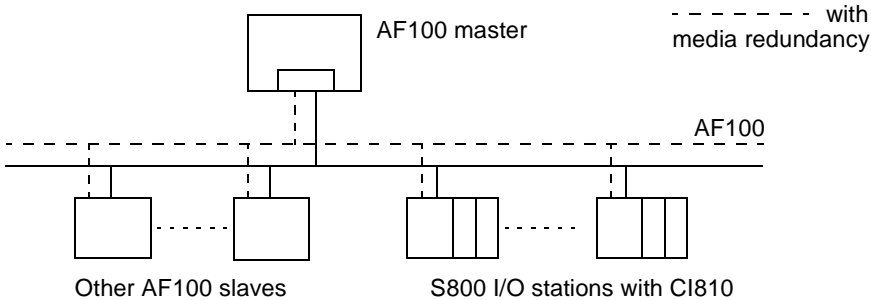


Figure 2-2. An AF100 configuration with/without media redundancy example

Advant Fieldbus 100 with redundancy

Redundancy on Advant Fieldbus 100 includes redundant cable and redundant modems and redundant CI820 FCI together with the interconnecting unit TB815.

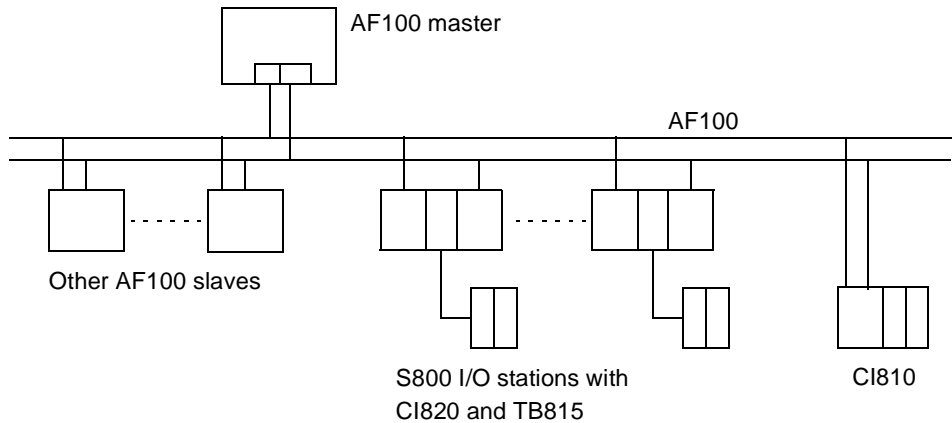


Figure 2-3. An AF100 configuration with redundancy example

2.2 Communication

S800 I/O uses Advant Fieldbus 100 or PROFIBUS-DP as an external communication interface and Modulebus as an internal communication link between clusters and their I/O modules.

Advant Fieldbus 100

S800 I/O and a communication interface module can be directly connected to Advant Fieldbus 100, twisted pair, and to any other media using a converting modem. When connected to Advant Fieldbus 100, the communication interface module and its S800 I/O modules are called an S800 I/O Station.

An S800 I/O station works as a slave for one parent controller. If several S800 I/O stations are connected to the same Advant Fieldbus 100 together with more than one controller, each S800 I/O station needs its own dedicated parent controller. See Figure 2-4.

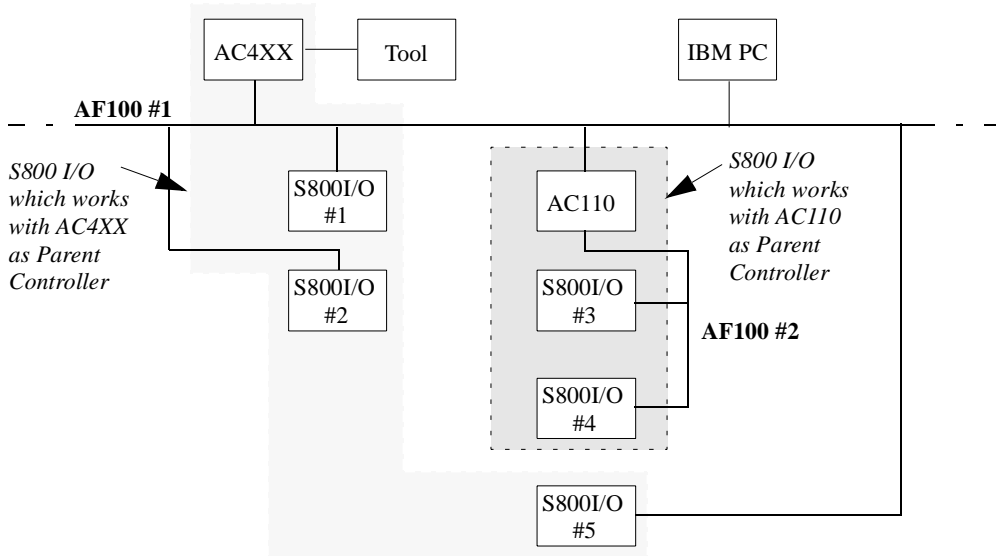


Figure 2-4. Connection to Advant Fieldbus 100

Profibus

S800 I/O and a communication interface module can be directly connected to PROFIBUS-DP network.

An S800 I/O station works as a modular slave.

Modulebus

A Fieldbus Communication Interface module communicates with its S800M I/O modules and/or S800L I/O modules over the Modulebus internally in the base cluster and externally with other additional clusters within the same S800 I/O station by using Optical Modulebus modems. The Optical Modulebus modems are connected via optical cables to a Modulebus Optical port module on the communication interface module.

The maximum length of the Optical Modulebus expansion is dependent of the number of Optical Modulebus modems. The maximum length between two clusters are 15m (49ft.) with plastic fibre and 200m (667ft) with HCS glass fibre. Factory made optical cables (plastic fibre) are available in lengths of 1.5, 5 and 15m (5, 16 or 49ft.).

Within a cluster, the electrical Modulebus is made up of increments integrated into each MTU and S800L modules. Each communication interface module and Optical Modulebus modem have a Modulebus outlet connector to connect to an MTU or S800L module. An MTU and S800L module has a bus inlet and a bus outlet connector. By adding, an MTU or S800L module to a communication interface module or a Optical Modulebus modem, the bus is automatically expanded, offering optional further expansion of MTUs or S800L modules to a maximum of 12 MTUs or S800L modules. The electrical Modulebus can be divided up in sections by using Extension cables, Figure 4-14. The electrical Modulebus must not exceed 2.5 m (100"). Unique position codes are automatically assigned to each MTU or S800L modules as the bus is expanded.

The Optional Modulebus expansion can be built up in three ways:

- simplex (ring) communication configuration. See Figure 2-5
- duplex communication configuration. See Figure 2-6
- simplex/duplex mixed configuration. See Figure 2-7.

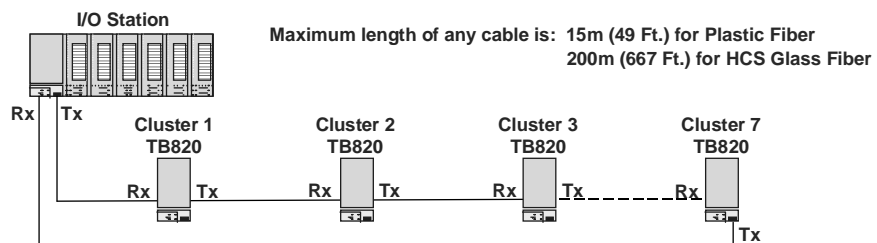


Figure 2-5. Optical Modulebus and I/O clusters, simplex communication

- Simplex provides a one-way ring connection from the FCI to the first TB820, to the second TB820, etc., and back from the last TB820 to the FCI.

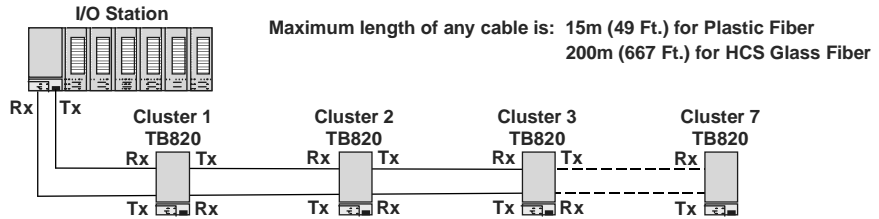


Figure 2-6. Optical Modulebus and I/O clusters, duplex communication

- Duplex provides a two-way ring connection, and is normally the best communication design
- Duplex allows additional TB820s to be added down-stream on-line
- A cable break or loss of a TB820 will only affect I/O Clusters down-stream of the failure

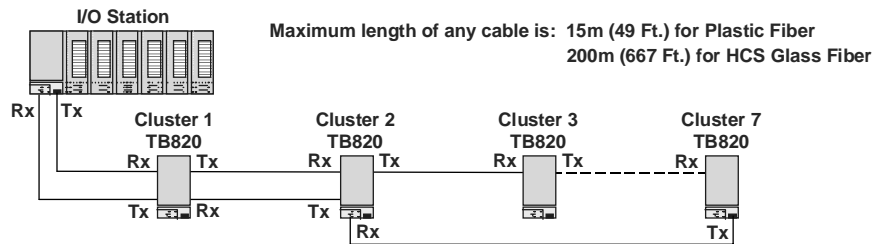


Figure 2-7. Optical Modulebus and I/O clusters, mixed communication

- Simplex and Duplex can be mixed in the same optical ModuleBus if required
- A cable break or loss of a TB820 will only affect I/O Clusters down-stream of the failure, for the Duplex portion of the ring.

2.3 Fieldbus Communication Interface

A Fieldbus Communication Interface module is used as communication interface to connect S800 I/O modules to the fieldbus.

There are three different FCI modules:

- CI810A for Advant Fieldbus 100, with or without media redundancy
- CI820 for Advant Fieldbus 100 fully redundant communication
- CI830 for Profibus

They all have an isolated input for 24 V d.c. power (19.2 - 30 V). The power source can be the SD811/SD812 power supplies, battery, or other IEC664 Installation Category II power sources. Power status inputs, 2 x 24 V, to monitor 1:1 redundant mains are also provided.

When a fully redundant communication solution is **not** required, use CI810A

CI810A have two connectors and modems for a media redundant Advant Fieldbus 100 twisted pair cables and a connection for the Optical Modulebus.

CI820, together with the interconnection unit TB815, is used when a fully redundant configuration is required. CI820 comprises the Advant Fieldbus 100 twisted pair connection and TB815 the Optical Modulebus connection.

CI830 have a 9 pin D-sub connector and modems for POROFIBUS-DP and a connection for the Optical Modulebus.

The front plate of the communication modules provides LEDs for diagnostic and status indications. Two rotary switches are provided for setting of the I/O station address. No other addresses are required to be set within the I/O-station. Labels for optional user text and item number are also provide. The communication plugs can be inserted/removed without interrupting the communication between stations on the bus.



The type designation CI810 in this document includes all types of this model (for example CI810A), if no other information is given.

Table 2-2. Fieldbus communication interface

Module Type	Description
CI810	2 x Advant Fieldbus 100 Modems for twisted pair cable. Power supply 24V (19.2-30V), Rated isolation voltage 50V.
CI820	Advant Fieldbus 100 FCI for redundancy configuration. Advant Fieldbus 100 modem for twisted pair cable. Power supply 24V (19.2-30V), Rated isolation voltage 50V.
CI830	Profibus Modem for twisted pair cable Power supply 24 V (19.2 - 30 V d.c.) Rated isolation voltage 50 V.

2.4 Module Termination

The MTUs are totally passive units and all active circuitry is allocated to the I/O module containing process connections and Modulebus part. Please, see Section 4.2, Module Termination Unit, for further information.

Table 2-3. S800M I/O Termination Units

Module Type	Description
TU810	Compact MTU, 3*8 + 2*3 terminals, 50V
TU811	Compact MTU, 2*8 terminals, 250V
TU812	Compact MTU, 25 pin D-sub Connector for field connection, 50V
TU814	Compact MTU, Crimp Snap-in Connector for field connection, 50V
TU830	Extended MTU, 3*16 + 2*4 terminals, 50V
TU831	Extended MTU, 8*2 terminals, 250V
TU835	Extended MTU, 4*2 groups + 2*4 power terminals, 50V, individually fused per channel
TU836	Extended MTU, 2*4 groups + 2*6 power terminals, 250V, individually fused per channel

Table 2-3. S800M I/O Termination Units (Continued)

Module Type	Description
TU837	Extended MTU, 2*4 groups + 2*6 power return terminals, 250V, fused
TU838	Extended MTU, 2*4 groups + 2*4 power return terminals, 50V, fused
TU890	Compact MTU, I.S. applications, 50V

2.5 I/O Modules

There are two types of S800 I/O modules:

- **S800M** I/O modules
designed to be used together with the Module Termination Units. You may hot-swap S800M I/O modules.
- **S800L** I/O modules.
designed to be directly mounted on a standard DIN-rail and containing process connections and Modulebus parts.

A lot of I/O modules are available, covering analog and digital signals of various types, and interfaces for RTDs and TCs of various types.

For positioning applications using incremental encoders, a special interface unit is available comprising a complete positioning loop.

The S800 I/O system provides I/O modules with typically 2-16 channels depending on type and ratings of the individual module.

All I/O modules are supervised at system start-up as well as under normal operation. The status of a S800M module is indicated with front mounted LEDs; RUN (R), green, normal operation, FAULT (F), red, when a fault is detected, WARNING (W), yellow, when a channel fault is detected and OUTPUT SET AS PREDETERMINED (OSP), yellow, when the module has lost communication. S800L I/O modules only have one status LED showing RUN (green) and FAULT (red). All S800M I/O modules can be replaced with both system power and field power connected.

Digital I/O Modules

The digital I/O modules all have galvanic isolation relative to chassis ground. All modules have LEDs to indicate channel status (on/off) and the standard set of module status indicators.

Some output modules and modules with Intrinsic Safety interfaces have indication for the channel error status.

The S800M I/O modules 24/48V d.c. have two isolated groups with 8 channels each. Each group has a field power status input to indicate presence of field power. Loss of field power is indicated on Warning LED, module status set to warning and channel status set to error.

The 120/250V a.c. or d.c. modules have individually isolated channels. The input module can be configured to monitor field power status.

S800L I/O modules have one isolated group with 16 channels. The input modules can be configured to monitor field power status. Loss of field power will set module status to warning and channel status to error.

Outputs do not need external inductive load suppression components.

Table 2-4. S800 Digital Modules

Module Type	Type ⁽¹⁾	Description	Suitable MTU
DI801	L	Digital Input 24 V d.c., 1*16 channels ⁽²⁾ Rated isolation voltage 50 V	-
DI810	M	Digital Input 24 V d.c., 2*8 channels ⁽³⁾ Rated isolation voltage 50 V	TU810 TU812 TU814 TU830 TU838
DI811	M	Digital Input 48 V d.c., 2*8 channels ⁽¹⁾ Rated isolation voltage 50 V	TU810 TU812 TU814 TU830 TU838

Table 2-4. S800 Digital Modules (Continued)

Module Type	Type ⁽¹⁾	Description	Suitable MTU
DI814	M	Digital Input 24 V d.c. 2*8 channels ⁽³⁾ , current source. Rated isolation voltage 50 V	TU810 TU812 TU814 TU830 TU838
DI820	M	Digital Input 120 V a.c., 110 V d.c., 8*1 channels Rated isolation voltage 250 V	TU811 TU831
DI821	M	Digital Input 230 V a.c., 220 V d.c., 8*1 channels Rated isolation voltage 500 V	TU811 TU831
DI830	M	Digital Input 24 V d.c. 2*8 channels SOE handling. Rated isolation voltage 50 V.	TU810 TU812 TU814 TU830 TU838
DI831	M	Digital Input 48 V d.c. 2*8 channels SOE handling. Rated isolation voltage 50 V.	TU810 TU812 TU814 TU830 TU838
DI885	M	Digital Input 24/48 V d.c. 1*8 channels open-circuit monitoring, SOE handling. Rated isolation voltage 50 V	TU810 TU812 TU814 TU830
DI890	M	Digital Input, I.S. interface, 1*8 channels Rated isolation voltage 50 V	TU890
DO801	L	Digital Output 24 V d.c. 0.5A short circuit proof, 1*16 channels ⁽²⁾ . Rated isolation voltage 50 V	-

Table 2-4. S800 Digital Modules (Continued)

Module Type	Type ⁽¹⁾	Description	Suitable MTU
DO810	M	Digital Output 24 V d.c. 0.5A short circuit proof, 2*8 channels ¹ Rated isolation voltage 50 V	TU810 TU812 TU814 TU830
DO814	M	Digital Output 24 V d.c. 0.5 A short circuit proof, 2*8 channels ⁽³⁾ , current sink. Rated isolation voltage 50 V	TU810 TU812 TU814 TU830
DO815	M	Digital Output 24 V d.c. 2 A short circuit proof 2*4 channels, current sink Rated isolation voltage 50 V.	TU810 TU812 TU814 TU830
DO820	M	Digital Output Relay 8*1 channels 24-230 V a.c. 3A cos $\varphi > 0.4$ d.c. < 42W. Varistor protected. Rated isolation voltage 250 V	TU811 TU831 TU836 TU837
DO821	M	Digital Output Relay 8*1 normally closed channels 24-230 V a.c. 3 A cos $\varphi > 0.5$ d.c. < 42 W. Varistor protected. Rated isolation voltage 250 V.	TU811 TU831 TU836 TU837
DO890	M	Digital Output 12V 40 mA, I.S. interface, 1*4 channels Rated isolation voltage 50 V	TU890
DP820	M	Pulse Counter 2 channels Pulse Count and frequency measurement 1.5 MHz. Rated isolation voltage 50 V.	TU810 TU812 TU814 TU830

- (1) Type L = S800L I/O, type M = S800M I/O
(2) 1*16, equals 1 groups of 16 channels
(3) 2*8, equals 2 groups of 8 channels

Analog I/O Modules

The analog I/O modules all have galvanic isolation relative to chassis ground in a group of 4 or 8 channels. The modules have the standard set of module status indicators.

Open circuit detection is available for inputs and outputs configured for 4...20mA and for the RTD and TC inputs.

Table 2-5. S800 Analog Modules

Module Type	Type ⁽¹⁾	Description	Suitable MTU
AI801	L	Analog Input 1*8 channels. 0...20mA, 4...20mA, 12 bit., 0.1% Current shunt resistor 250Ω is protected to 30V. Rated isolation voltage 50V.	-
AI810	M	Analog Input 1*8 channels. 0...20mA, 4...20mA, 0...10V, 2...10V, 12 bit., 0.1% Current shunt resistor 250Ω is protected to 30V. Rated isolation voltage 50V.	TU810 TU812 TU814 TU830 TU835 TU838
AI820	M	Analog Input differential 1*4 channels. -20...20mA, 0...20mA, 4...20mA, -5...5V, 0...5V, 1...5V, -10...10V, 0...10V, 2...10V, 14 bit + sign, 0.1%, CMV 50V. Current shunt resistor 250Ω is protected to 30V. Rated isolation voltage 50V	TU810 TU812 TU814 TU830
AI830	M	Analog Input 1*8 ch, Pt100 (-80... 80°C, -200 ... 250°C, -200 ... 850°C), Ni100 (-60 ... 180°C), Ni120 (-80 ... 260°C), Cu10 (-100 ... 260°C) Resistor (0 ... 400Ω), 14 bit. Rated isolation voltage 50V.	TU810 TU812 TU814 TU830

Table 2-5. S800 Analog Modules (Continued)

Module Type	Type ⁽¹⁾	Description	Suitable MTU
AI835	M	Analog Input 1*8 ch Termo Couples (TC), type B (0 ... 1820°C), type C (0 ... 2300°C), type E (-270 ... 1000°C), type J (-210 ... 1200°C), type K (-270 ... 1372°C), type N (-270 ... 1300°C), type R (-50 ... 1768°C), type S (-50 ... 1768°C), type T (-270 ... 400°C), linear -30 ... 75 mV, 14 bit. Rated isolation voltage 50V.	TU810 TU812 TU814 TU830
AI890	M	Analog Input 1*8 channels. 0...20mA, 4...20mA, 12 bit I.S. interface Rated isolation voltage 50 V	TU890
AO801	L	Analog Output 1*8 channels, 0...20mA, 4...20mA, 12 bit. RL maximum 850 Ohms. Rated isolation voltage 50V.	-
AO810	M	Analog Output 1*8 channels, 0...20mA, 4...20mA, 14 bit. RL maximum 500/1000 Ohms. Rated isolation voltage 50V.	TU810 TU812 TU814 TU830
AO820	M	Analog Output 4*1 channels, -20...20mA, 0...20mA, 4...20mA, -10...10V, 0...10V, 2...10V, 12 bit + sign, 0.2%, individually isolated. Current output RL maximum 550 Ohms. Voltage output RL minimum 2 kohms. Rated isolation voltage 50V.	TU810 TU812 TU814 TU830
AO890	M	Analog Output 1*8 channels. 0...20mA, 4...20mA, 12 bit, I.S. interface Rated isolation voltage 50 V	TU890

(1) Type L = S800L I/O, M = S800M I/O

2.6 Drives Integration

ABB Standard and Engineered drives can be connected to the S800 I/O system. The FCI works as a communication link between the fieldbus master and the drives. No application software concerning this functionality is stored in the FCI.

The following drives are considered to be standard drives:

- ACS 600 with standard application (SingleDrive ACS)
- ACS 600 Programmable drive which is configured to respond as a standard drive
- ACS 600 MotionControl (ACP)
- ACS 600 Pump&FanDrive (ACF)
- ACS 600 CraneDrive (ACC) which is configured to respond as a standard drive

The following drives are considered to be engineered drives:

- ACS 600 with system application (MultiDrive ACA)
- ACS 600 Programmable drive which is configured to respond as an engineered drive
- DCS 600 MultiDrive using AMC-DC board
- DCS 500B using CON2 board
- ACS 600 CraneDrive (ACC) which is configured to respond as an engineered drive

Product Benefits

By integrating drives and the control system, full advantage can be taken to added functions. Process data are measured with improved accuracy for even more exact process control, while the ready made information permits a total overview of the drives in the process.

Features

The drives integration includes features such as:

- Fieldbus solutions which results in lower wiring costs.
- Optical transmission between FCI and drives allows installations in an electrical disturbed environment.
- Faults in drives available as alarms and in diagnostic displays reduces trouble shooting and maintenance costs.
- Warnings from drives available as events and in diagnostic displays allows the operator to determine when preventive service is needed.
- Predefined type circuit solutions reduces project engineering and commissioning.

The connection is made directly to the drives system through an optical ring or a star by using a Distributed Branching Unit. One important aspect is the simplicity in the connection. No extra hardware is needed in any of the devices, that is, the functions are included in the basic products, minimizing communication delays and cost.

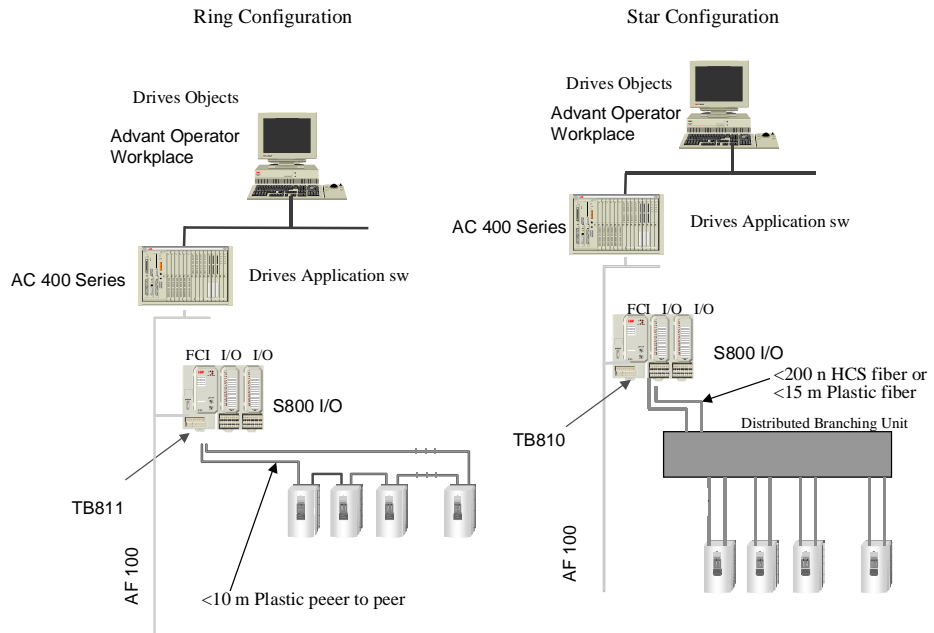


Figure 2-8. Examples of drives integration

Information from the drives:

Process values are sent as cyclic data, with an updating frequency decided by the application engineer. The data enables the control system to have access to basic information such as speed, current, torque and diagnostic information.

Information from the fieldbus master:

A setpoint for speed or torque in percentage or absolute values can be sent. It is also possible to give commands to the drive, for example, start, stop and fault reset.



TB810 is equipped with a transmitter/receiver for up to 10 Mbit/s and TB811 for up to 5 Mbit/s. A Modulebus got to have the same type of transmitter/receiver on each node.

2.7 Support for connections to instruments in Hazardous Areas

S800 I/O provide to possibilities to connections of instruments in Hazardous areas. Integrated with special I/O modules and support for external Intrinsic Safety systems.

2.7.1 Integrated Intrinsic Safety Interfaces

The S800 I/O includes I/O modules and MTUs with Intrinsic Safety interfaces, namely AI890, AO890, DI890, and DO890. The interfaces are classified Ex ia, Group IIC.

Correct and safe operation of the Intrinsic Safety aspects of MTU and I/O Modules with Intrinsic Safety interfaces calls for expert installation and commissioning as well as correct operation and meticulous maintenance. Only those persons conversant with the installation commissioning, operation and maintenance of similar apparatus and who has the necessary qualifications should work on these products.

Make sure installation is carried out observing the safety regulations pertaining to the installation and operation of electrical systems and the directives and guidelines on explosion protection (Hazardous Area equipment should comply with the descriptive system document).

The set of I/O modules and MTUs **are not** intended for hazardous area installation unless it is included in a suitable enclosure which conforms to the applicable standards. To mount the equipment in a Zone2 hazardous area then an enclosure or cabinet which provides ingress protection of IP54 rating is required.

For I.S. applications, the maximum limit for AC power supply is 250 V_{rms} and the user must ensure that the DC power supply to the FCI and I/O is limited to 60V.

2.7.2 Support for External Intrinsic Safety System

Intrinsic Safety System from ELCON Instruments (manufacturer outside ABB) is supported via S800 I/O modules and a special MTU.

Supported Intrinsic Safety System is the HiD Series 2000.

The S800 I/O modules are connected via MTU TU812, a standard cable from ELCON Industries and a specific adapter board, one for each I/O module types according to Table 2-6. Standards cables 0.2 m (0.66 ft) and 1.3 m (4.3 ft). Max cable length 100 m (109 yd).

Table 2-6. Supported modules and Intrinsic Safety components

ABB delivery		ELCON Instruments delivery		
S800 I/O module	Terminal unit	Termination and adaptor board	Intrinsic Safety modules	Note
AI810	TU812	2108/HAT/ABB-AI-H-01	2026, 2030, 2062, 2072	Dual channel modules
		2108/HAKE/ABB-AI-H-01 ⁽¹⁾	2026, 2030 using passive connection	Dual channel modules
AO810	TU812	2108/HAT/ABB-AO-H-01	2032, 2034, 2038	Dual channel modules
		2108/HAKE/ABB-AO-H-01 ⁽¹⁾	2032, 2034, 2038	Dual channel modules
DI810	TU812	2108/HAT/ABB-DI-01	2824, 2844	Quad channel modules
DO810	TU812	2108/HAT/ABB-DO-01	2872, 2874, 2876, 2878	Dual channel modules
		2108/HAKE/ABB-DO-H-01 ⁽¹⁾	2872, 2874, 2876, 2878	Dual channel modules

(1) Loop-disconnected terminals

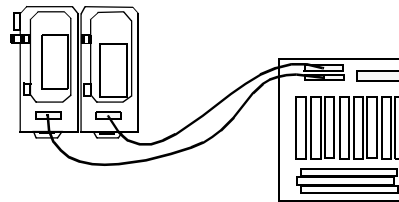


Figure 2-9. Example of Connection between S800 I/O and Intrinsic Safety System from ELCON

ELCON Instruments can provide a HART protocol connection to I/O modules integrated with the Intrinsic Safety system using the MUX 2700 Remote Board for HART.

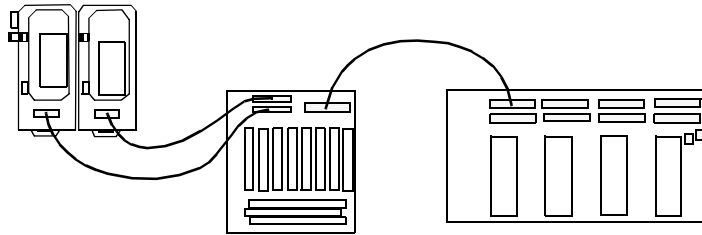


Figure 2-10. Example of Connection between S800 I/O and Intrinsic Safety System and HART Protocol Connection

Chapter 3 Software Components

The system software of a Fieldbus Communication Interface comprises a real-time operating system. The software is installed at delivery.

Upgrade kit is available for the system software for field upgrade.

Chapter 4 Hardware Components

The highly modularized hardware of S800 I/O includes the following components:

- Fieldbus Communication Interface
- Optical Modulebus modem
- I/O modules
- Module Termination Units (MTUs).

The communication interface modules, Optical Modulebus modem, MTUs and S800 I/O modules are mounted on standard DIN-mounting rails according to DIN EN50033-35*15.

An S800 I/O station can consist of a base cluster and up to 7 additional I/O clusters. The base cluster consists of a communication interface module and up to 12 I/O modules. I/O cluster 1 to 7 consist of an Optical Modulebus modem (TB820V1) and up to 12 I/O modules. An S800 I/O Station can have of up to 24 I/O modules in total. I/O cluster 1 to 7 are connected to the communication interface module through an optical expansion of the Modulebus (TB810).

4.1 I/O Modules

There are two types of S800 I/O modules:

- S800M I/O modules
designed to be used together with the Module Termination Units.
- S800L I/O modules.
designed to be directly mounted on a standard DIN-rail and containing process connections.

4.2 Module Termination Unit

Module Termination Units (MTUs) act as I/O module carriers and are available as Compact, Extended and Intrinsic Safety MTUs. A Compact MTU normally offers termination of one wire per channel for a 16 channel module. With Compact MTUs

power distribution of field circuits must be made with external terminal blocks and current limiting components if required. Extended MTUs with group-wise isolated interfaces allow for two or three wire termination of field circuits and provide group-wise or individually fuses for powering field objects. Extended MTUs which offer two or three wire terminations allows direct field object cable termination. The need for external marshalling is therefore drastically reduced or eliminated when Extended MTUs are used. An Intrinsic Safety MTU offers termination of field objects located in hazardous areas.

Compact and Intrinsic Safety MTUs are 58mm (2.3”) wide and Extended MTUs are 120mm (4.72”) wide. The MTU types can be mixed and matched within an I/O-station to fit a user’s needs. Choice of MTU type can be made freely trading space versus termination needs.

MTUs are available with rated isolation voltages 50 V and 250 V. The 50 V types can be used with all 24/48 V discrete I/O and analog I/O modules. The MTUs with 250 V rated isolation voltage are used with all 120 V and 250 V rated I/O modules

An inserted I/O module is assigned the unique position identity of its MTU. Through the incremental bus design the physical size of an S800 I/O installation is directly proportional to the number of installed MTUs.



The S800M I/O modules can be inserted and removed from MTUs without disturbing system operation.

The physical lock for S800M I/O which locks an I/O module to its MTU allows I/O module removal only when the lock is in its unlocked position. The locking mechanism also acts as a logic lock so that an I/O module is operable only when the lock is in the locked position. If the lock is in its unlocked position, output channels are de-energized and I/O modules can be inserted/removed without need to remove system or field power.

The S800L modules have only mechanical lock device and can not be removed with power on.

MTUs and S800L I/O modules can within a cluster be set up in two or three physically separated groups with extension cable adaptors which fit to the bus outlet and inlet connectors of communication interface modules, Optical Modulebus

modem, MTUs and S800L modules. The factory made extension cables which plug into the cable adaptors are available in lengths of 0.3, 0.6 and 1.2 m (1, 2 or 4 ft.), allowing together with up to 12 I/O modules, for a total bus length of 2.5 m (8.2 ft.).

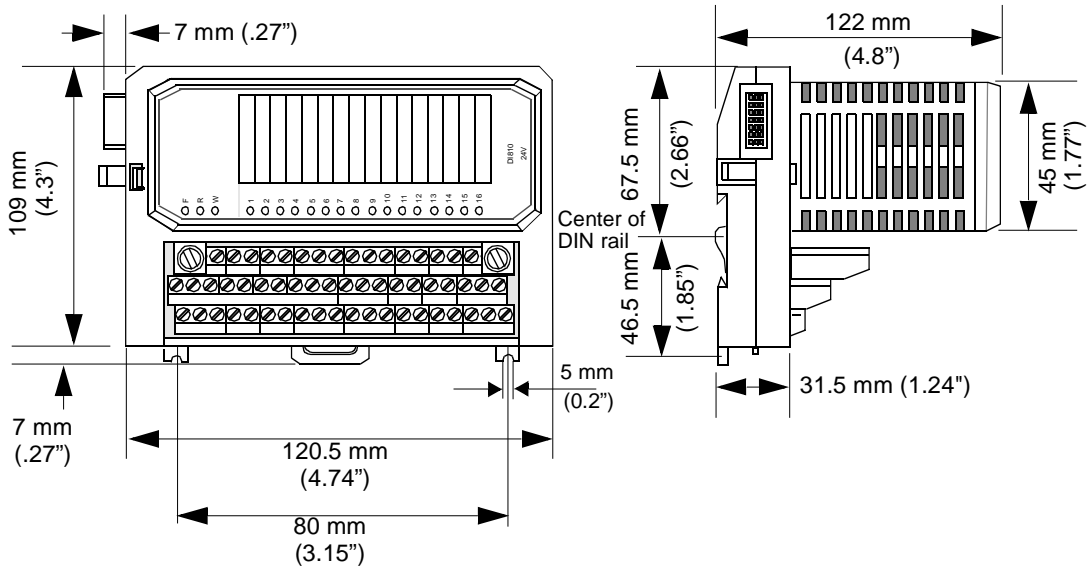


Figure 4-1. Typical Extended MTU with I/O Module

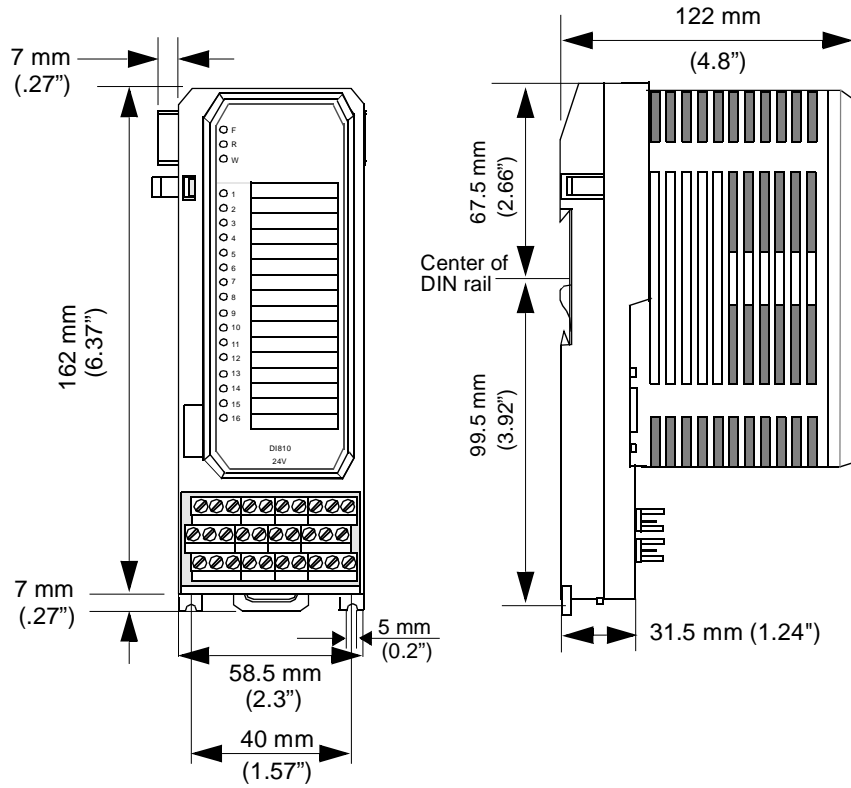


Figure 4-2. Typical Compact MTU with I/O Module

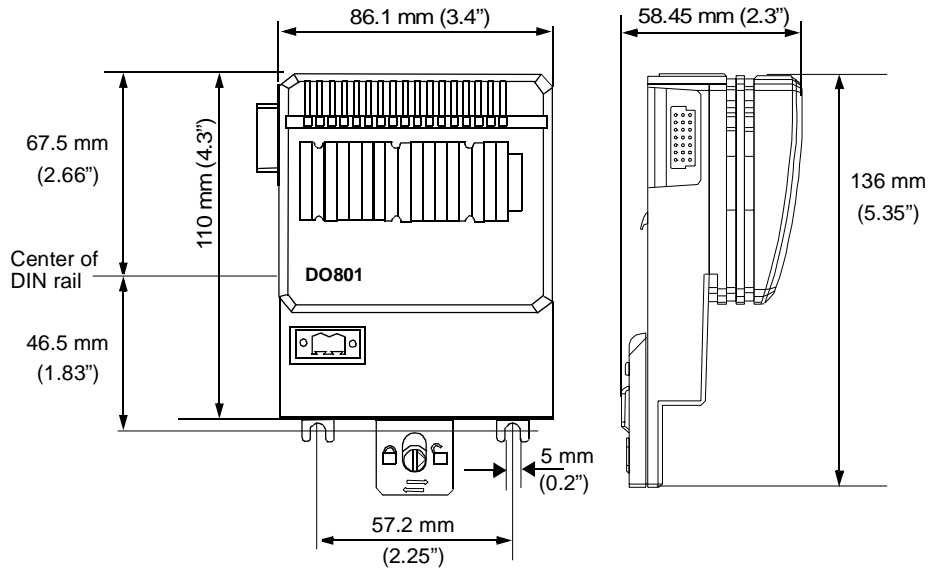


Figure 4-3. Dimensions for S800L Modules

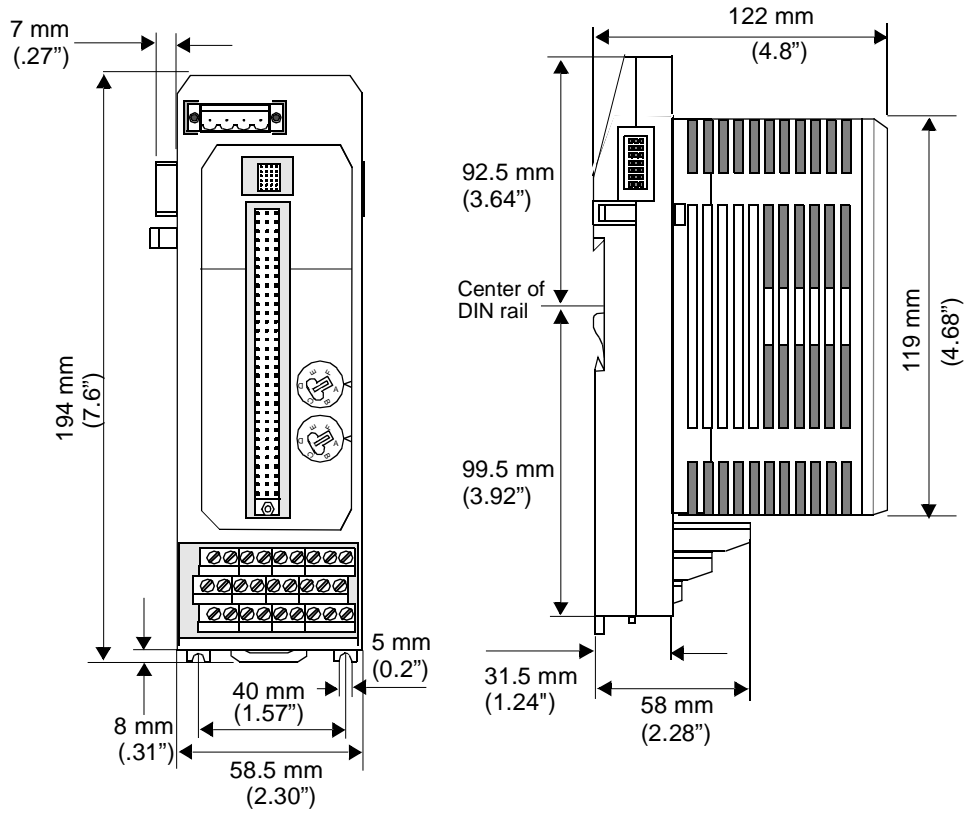


Figure 4-4. Compact MTU for Intrinsic Safety without and with I/O Module

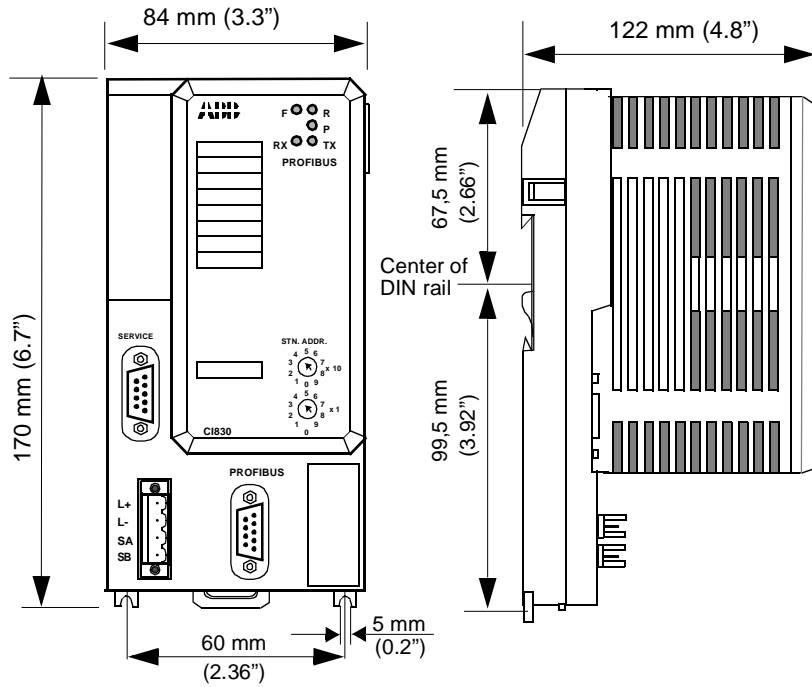


Figure 4-5. CI810 and CI830 FCI Dimensions

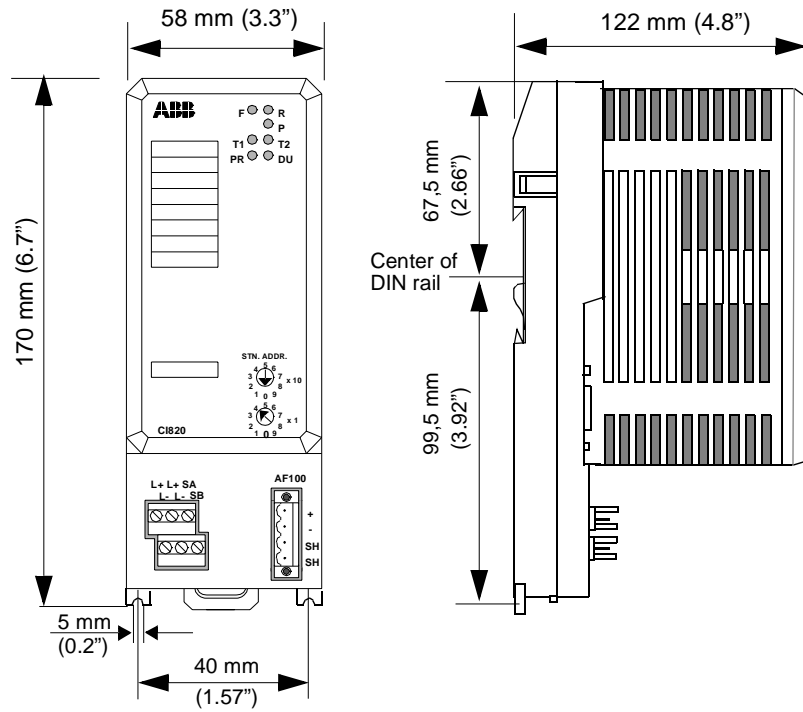


Figure 4-6. CI820 FCI Dimensions



The flexibility of the system allows both **horizontal** and **vertical** mounting of the rail with mixing of MTU and I/O types. Figure 4-7 and Figure 4-8 refers.

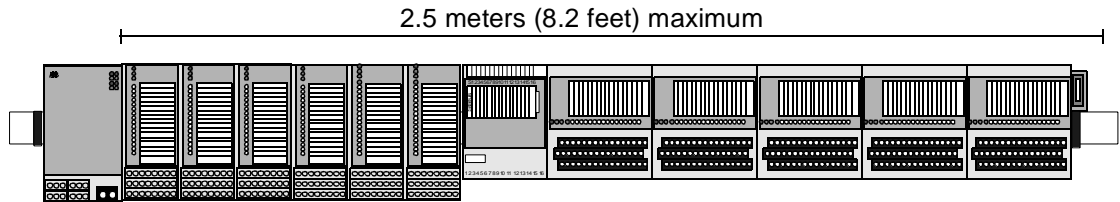


Figure 4-7. Typical I/O Station Base Cluster with S800 I/O. Horizontal mounting.

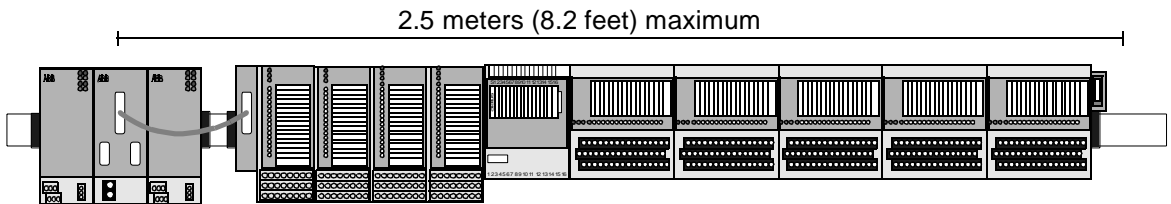


Figure 4-8. Typical I/O Station Base Cluster with Redundant FCIs to S800 I/O. Horizontal mounting.

S800M I/O modules may be exchanged during system operation. A module locking mechanism disconnects Modulebus and process signals safely from the module. A newly inserted I/O module is automatically put into operation if the system identifies the module as being of the correct type and without faults.

4.3 Modulebus Items

The Modulebus supports up to 8 cluster, one base cluster and up to 7 I/O cluster, connected to each other via optical cables, Optical Modulebus modems and a Modulebus Optical port module. MTUs and S800L I/O modules can within a cluster be set up in two or three groups with extension cable adaptors fitting the bus outlet and inlet connectors of communication interface, MTUs and S800L modules. At the last MTU' or S800L modules bus outlet a terminator module, TB807, must be inserted.

Optical Modulebus Modem, TB820

Optical Modulebus modems TB820 have an isolated input for one 24 V d.c. power which also powers the Modulebus interfaces of the I/O modules. The power source can be the SD811/812 power supplies, battery, or other IEC664 Installation Category II power sources. Power status inputs, 2*24 V, to monitor 1:1 redundant mains are also provided. TB820 has four connectors for the optical cables and two connectors for power supply. The front plate of the Optical Modulebus modem provides LEDs for diagnostic and status indications. One rotary switch is provided for setting of the cluster address. No other addresses are required to be set within the I/O-cluster. Labels for optional user text and item number are also provided.

Modulebus Optical Port, TB810/TB811

The Modulebus Optical ports TB810/TB811 have two connectors for the Optical Modulebus expansion and one connector for connection to the communication interface module.

Table 4-1. Modulebus items

Module Type	Description
TB810	Modulebus Optical port with 10 Mbit driver for Modulebus Optical expansion used together with S800I/O and Drive equipment Option to the communication interface.
TB811	Modulebus Optical port with 5 Mbit driver for Modulebus Optical expansion used together with Drive equipments Option to the communication interface.

Table 4-1. Modulebus items (Continued)

Module Type	Description
TB820V1	Optical Modulebus modem. Optical and electrical Modulebus interface. Power supply 24 V (19.2-30 V), Rated isolation voltage 50 V.
TK811V015	Optical Modulebus expansion cable with connectors, duplex cable plastic fibre 1.5 m (4.9 ft.)
TK811V050	Optical Modulebus expansion cable with connectors, duplex cable plastic fibre 5 m (16.4 ft.)
TK811V150	Optical Modulebus expansion cable with connectors, duplex cable plastic fibre 15 m (49.2 ft.)
TK812V015	Optical Modulebus expansion cable with connectors, Optical simplex cable plastic fibre, 1.5 m (4.9 ft.)
TK812V050	Optical Modulebus expansion cable with connectors, Optical simplex cable plastic fibre, 5 m (16.4 ft.)
TK812V150	Optical Modulebus expansion cable with connectors, Optical simplex cable plastic fibre, 15 m (49.2 ft.)
TB805	Bus Outlet. Modulebus extent. cable adaptor D-sub 25, female
TB806	Bus Inlet. Modulebus extent. cable adaptor D-sub 25, male
TB807	Modulebus terminator. One each per base and I/O cluster
TK801V003	Modulebus extension cable. Shielded Cable 0.3m (1.0 ft.), D-sub 25, male, female
TK801V006	Modulebus extension cable Shielded cable 0.6m (2.0 ft.) D-sub 25, male, female
TK801V012	Modulebus extension cable Shielded cable 1.2m (4.0 ft.) D-sub 25, male, female
	Mounting rail DIN EN 50022-35 × 15 length 700 mm (2.3 ft.)
	Mounting rail DIN EN 50022-35 × 15 length 1200 mm (3.9 ft.)



Optical Modulebus expansion cables with other length and performance can be ordered from Hewlett Packard. Connectors, fibres and tools according to HP Versatile Link. Plastic optical fibre with low attenuation max length 15m (49ft.) for extended length max 200m (667ft.) HCS glass fibre and connectors.

4.4 Power Supplies

The power supplies SD811 and SD812 (24 V output) can be used to power processor modules and S800 I/O modules, through the processor unit and to power 24 V field circuits (optional). The supplies have a wide input voltage range, nominally 110 V-240 V without input voltage range selection. The primary side can connect to industrial mains installation class III (IEC664).

The outputs are short circuit proof and can operate with resistive, capacitive and constant power loads, for example, switched mode power converters.

The outputs of the supplies can be connected in parallel to increase power, 2*SD811 or 2*SD812, or be configured for redundant mains to increase availability, 2*SD811 or 2*SD812. Each supply has a power OK signal which can connect to the SA or SB inputs of the Communication interface module or an Optical Modulebus modem to monitor power status in 1:1 redundant mains configurations.

Table 4-2. Power supplies

Module Type	Description
SD811	Power Supply 100-240 Va.c./24 Vd.c. 2.5A Rated isolation voltage 300 V.
SD812	Power Supply 100-240 V a.c./24 V d.c. 5A Rated isolation voltage 300 V.

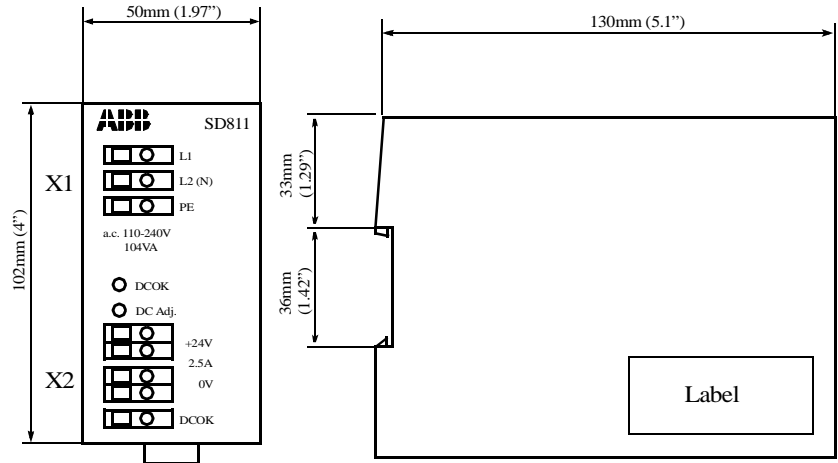


Figure 4-9. Power supply module SD811

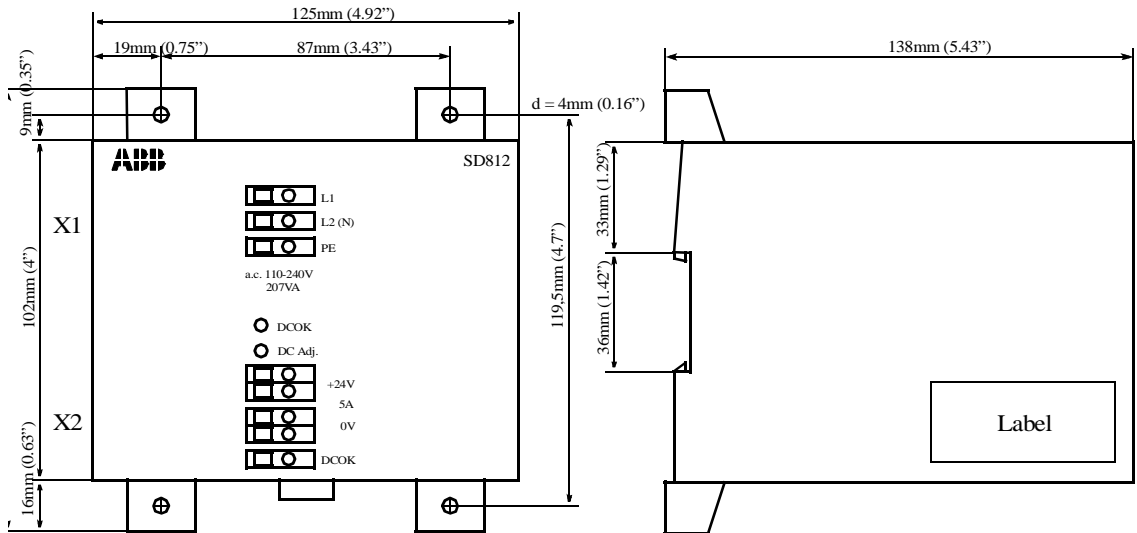


Figure 4-10. Power supply module SD812

4.5 Mounting

The I/O station can be mounted horizontally, vertically or in combinations (Figure 4-11 to Figure 4-15). Compact or Extended MTUs or S800L modules can be used depending on available space and preferred way of installing the field wiring (external marshalling/power distribution or direct on Extended MTUs using built in 2/3 wire termination and power distribution arrangements). Compact and Extended MTUs as well as S800L modules can be mixed and matched within the I/O station to suit the required field termination.



It is recommended to use end supports when mounting the I/O station.

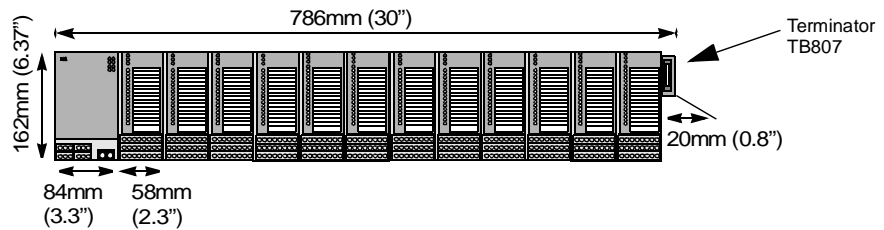


Figure 4-11. Horizontal mounting of 1 FCI (left) and 12 S800M I/O MTUs (Compact)

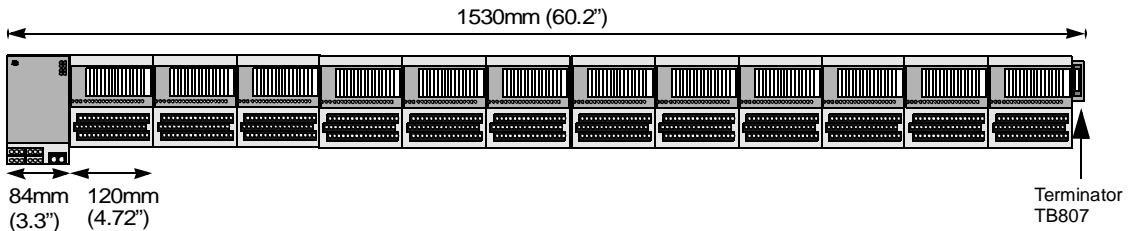


Figure 4-12. Horizontal mounting of 1 FCI (left) and 12 S800M I/O MTUs (Extended)

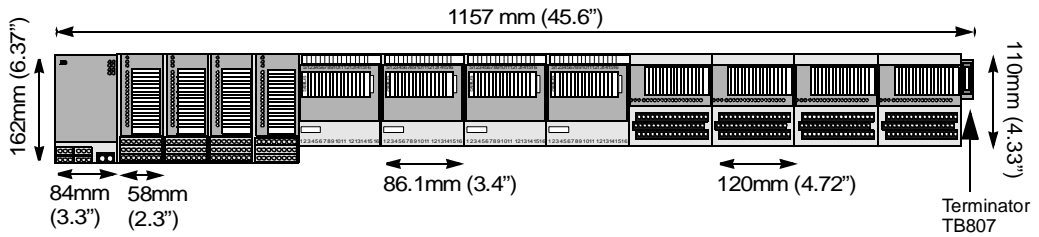


Figure 4-13. Mixed mounting of 1 FCI and 4+4+4 S800M I/O MTUs (Compact and Extended) and S800L I/O Modules

By using extension cable(s) a very flexible mounting arrangement is possible, adapting to required panel or cabinet layout. The maximum length of an electrical Modulebus should not be more when 2.5 m (100'').

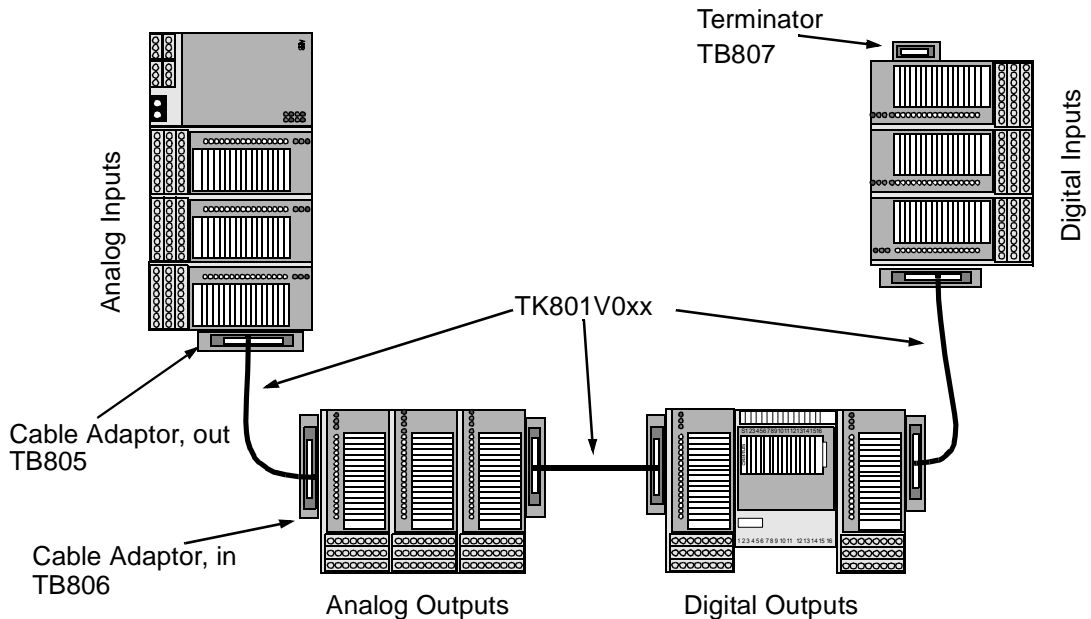


Figure 4-14. I/O Station in small groups



Modules with I.S. Interfaces **MUST** be mounted rightmost of the I/O station or as a separate group.

The installation must be performed by qualified personnel. It must comply with the relevant national/international standards (e.g. IEC 79-14, CEI 64-2, BS 5345 Pt. 4, DIN VDE 165) and in line with the established installation rules and recommended practice (e.g. CEI 64-8, ANSI/ISA RP-12.6). The conformity of hazardous area field devices with the related system documentation must always be checked.

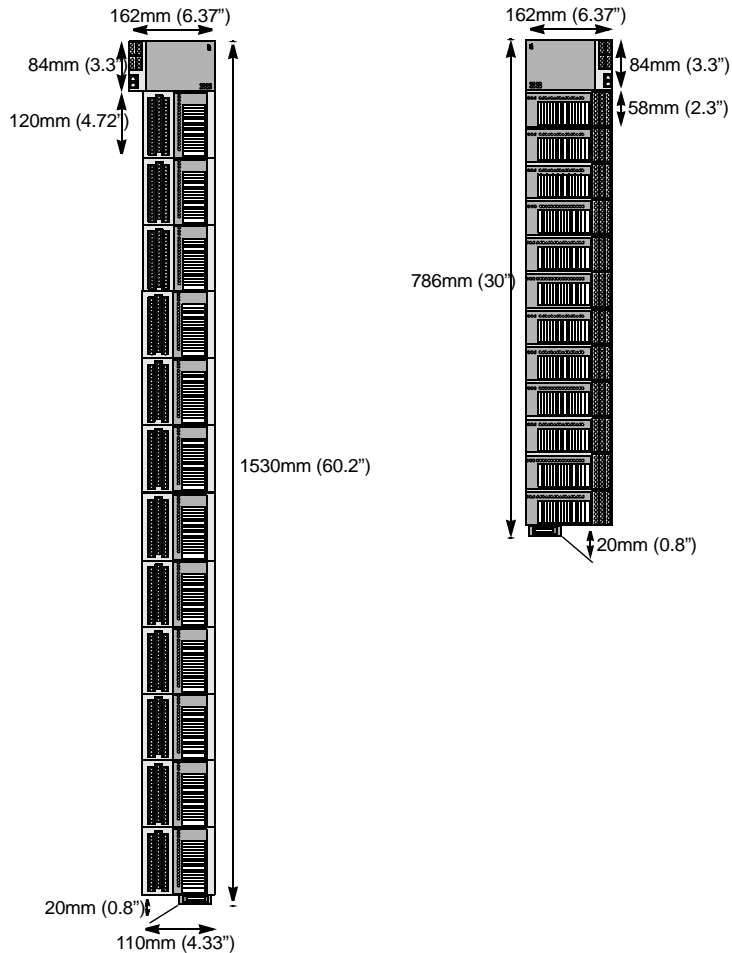


Figure 4-15. Vertical mounting of S800M I/O MTUs

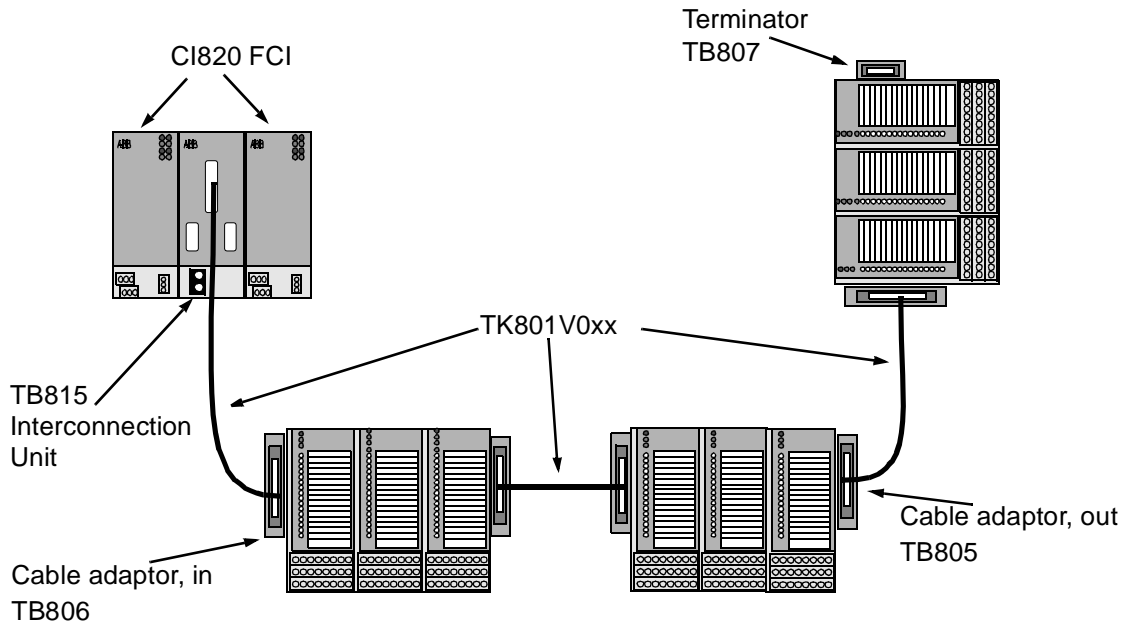


Figure 4-16. I/O Station with Redundant CI820 FCIs

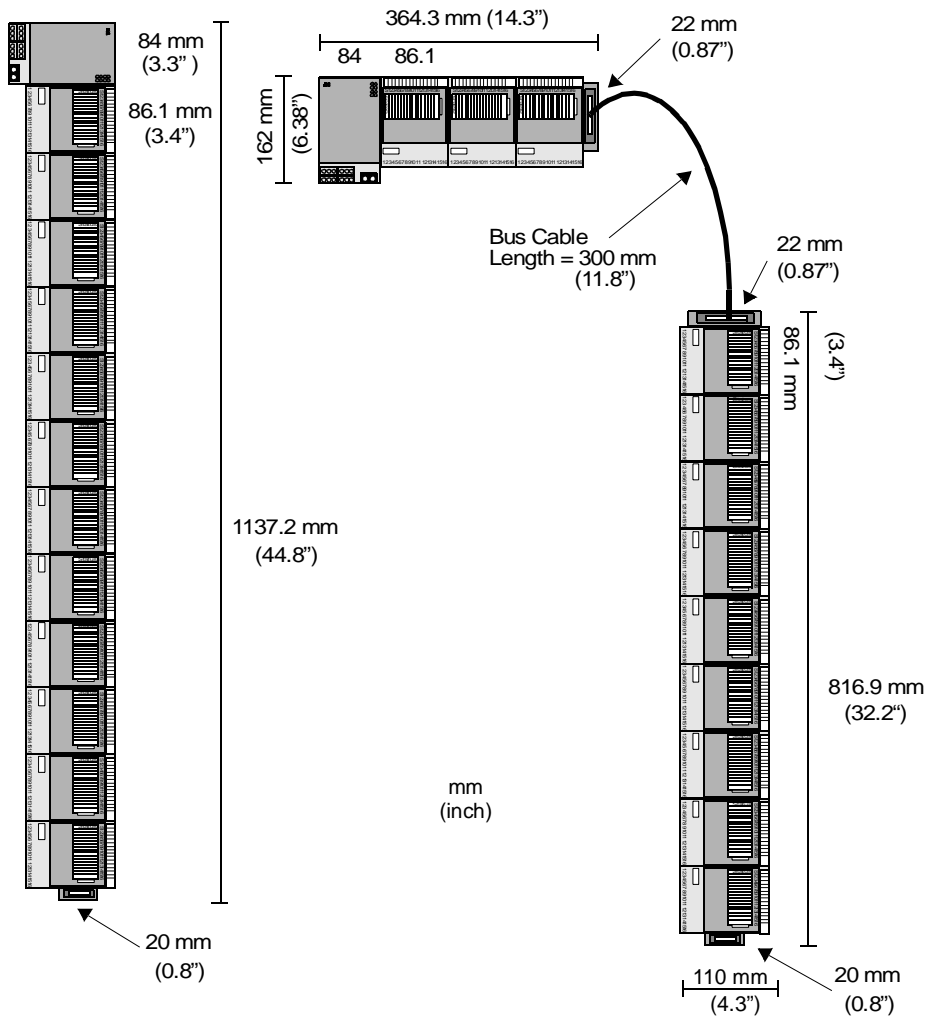


Figure 4-17. Maximum Layout of I/O Cluster with S800L

Chapter 5 Mechanical Design

5.1 Cabinets

RE810 wall cabinet can be used for the S800 I/O. All frame components are made of alu-zink coated steel and welded parts are electro galvanized.

For mounting measurement, see Figure 5-1 below.

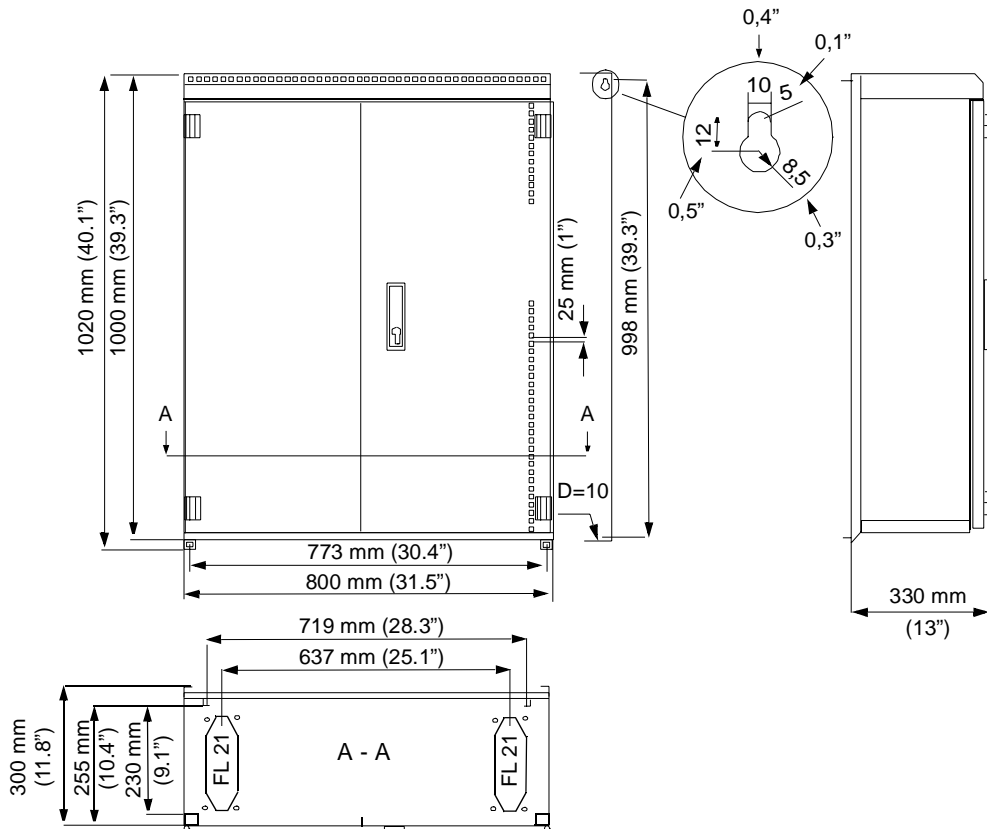


Figure 5-1. RE810 Cabinet Dimensions (measurements in mm and inch)

The cabinet can be mounted on a wall. The environment protection class for the RE810 cabinet is IP54 (only for indoor use).

Enclosure layouts examples are shown for two different stations. The examples of enclosure layouts are in a RE810 Cabinets (Figure 5-2 and Figure 5-3) which could house the S800 I/O Station with power supplies for system as well as for the field powering, and space for marshalling terminals.

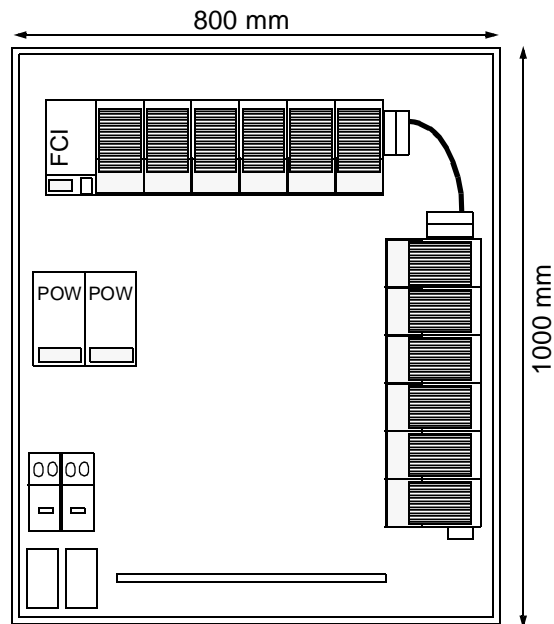


Figure 5-2. RE810 Cabinet with 12 I/O Modules and Redundant Power Supplies

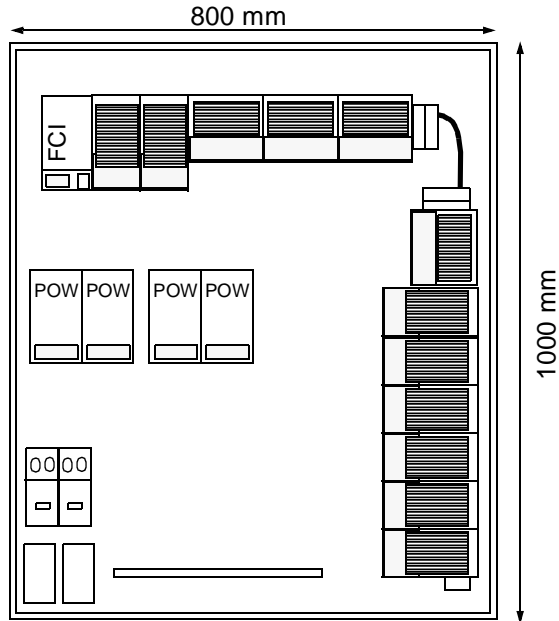


Figure 5-3. Enclosure with 12 I/O Modules and Redundant Power Supplies

Chapter 6 Environmental Immunities

The S800 I/O System is designed and manufactured by ABB Automation Products AB, which is certified according to the environmental protection standards ISO 14001.

For further information on the environmental immunity, please refer to the special data sheet *Environmental Data for ABB Products*.

Chapter 7 Technical Data and Performance

7.1 Capacity and Performance

7.1.1 Advant Fieldbus 100 Load

The bus load is calculated in with different figures according to the bus length:

- for bus length max 2000 m (2200 yards), use Table 7-1
- for bus length max 8500 m (9300 yards), use Table 7-2
- for bus length max 15000 m (16400 yards), use Table 7-3.

To calculate the bus load in percent (AF100% load), at the required Cycle Time, the CI8XX (FCI) loading per station and the I/O Module Type quantity times the per cent loading.

For bus load calculation, use the formula:

$$AF100\%_{load} = CI8XX_{load} + S800 \text{ I/O Module } 1_{load} + S800 \text{ I/O Module } n_{load} + \dots$$

7.1.1.1 Calculation of load for AF100 with a length of max 2,000 m (2,200 yards)

Due to the organization of the Advant Fieldbus 100 scans, some constraints are imposed on the transmissions. To guarantee message transfer etc., at least 30% of the fieldbus load is reserved. The remaining load (up to 70%) can be used for S800 I/O Station loading and other station loading.



The calculated load of Advant Fieldbus 100 must be equal to or less than 70%

Below is an example for an I/O Station with one CI810 FCI, 2 AI810s, two AO810s, four DI810s and four DO810s using 128ms cycle time for AI and AO modules and 64ms for DI and DO modules:

$$\text{AF100}_{\% \text{load}} = 0.033\% + (2 \times 0.197\%_{\text{AI810}}) + (2 \times 0.221\%_{\text{AO810}}) + (4 \times 0.138\%_{\text{DI810}}) + (4 \times 0.146\%_{\text{DO810}}) = 2.005\% \text{ Load}$$

Table 7-1. % of Load on the Advant Fieldbus 100 by S800 I/O (up to 2000 m Bus Length)

Cycle Time (ms)	Module Type								
	AI801 AI810 AI890	AI820	AI830 AI835	AO801 AO810 AO890	AO820	DI801, DI810 DI811, DI814 DI820, DI821 DI830, DI831 DI885, DI890	DO801 ⁽¹⁾ , DO810 ⁽¹⁾ DO814 ⁽¹⁾ , DO815 ⁽¹⁾ DO820 ⁽¹⁾ , DO821 ⁽¹⁾ DO890 ⁽¹⁾	DP820 ⁽²⁾ INSCANT	DP820 ⁽²⁾ OUT-SCANT
1	25.2%	15.6%	25.3%	25.23%	15.62%	8.8%	8.8%	25.2%	15.6%
2	12.6%	7.8%	12.6%	12.63%	7.815%	4.4%	4.4%	12.6%	7.8%
4	6.3%	3.9%	6.3%	6.325%	3.915%	2.2%	2.2%	6.3%	3.9%
8	3.15%	1.95%	3.15%	3.175%	1.965%	1.1%	1.1%	3.15%	1.95%
16	1.575%	0.975%	1.575%	1.6%	0.99%	0.55%	0.55%	1.575%	0.975%
32	0.788%	0.488%	0.788%	0.812%	0.503%	0.275%	0.275%	0.788%	0.488%
64	0.394%	0.244%	0.394%	0.418%	0.259%	0.138%	0.138%	0.394%	0.244%
128	0.197%	0.122%	0.197%	0.221%	0.137%	0.069%	0.069%	0.197%	0.122%
256	0.098%	0.061%	0.098%	0.123%	0.076%	0.034%	0.034%	0.098%	0.061%
512	0.049%	0.03%	0.049%	0.074%	0.046%	0.017%	0.017%	0.049%	0.030%
1024	0.025%	0.015%	0.025%	0.049%	0.03%	0.009%	0.009%	0.025%	0.015%
2048	0.012%	0.008%	0.012%	0.037%	0.023%	0.004%	0.004%	0.012%	0.008%
4096	0.006%	0.004%	0.006%	0.031%	0.019%	0.002%	0.002%	0.006%	0.004%

(1) Readbacks increase the load depending on the cyclicity and with the same amount as the net load at the cycle time. For Master the cycle time is 1024 which gives 0.009% more load. For MOD the cycle time is configurable.

(2) Total load = (load generated by INSCANT) + (load generated by OUTSCANT)
 The total load if INSCANT is 32 ms and OUTSCANT is 64 ms is:

$$\text{Total load} = 0.788 + 0.244 = 1.032\%$$

7.1.1.2 Calculation of load for AF100 with a length of max 8,500 m (9,300 yards)

Due to the organization of the Advant Fieldbus 100 scans, some constraints are imposed on the transmissions. To guarantee message transfer etc., at least 50% of the fieldbus load is reserved. The remaining load (up to 50%) can be used for S800 I/O Station loading and other station loading.



The calculated load of Advant Fieldbus 100 must be equal to or less than 50%.
NOTE! 1 ms cycle time is not allowed.

Table 7-2. % of load on the Advant Fieldbus 100 by S800 I/O (8,500 m Bus Length)

Cycle Time (ms)	Module Type								
	AI801 AI810 AI890	AI820	AI830 AI835	AO801 AO810 AO890	AO820	DI801, DI810 DI811, DI814 DI820, DI821 DI830, DI831 DI885, DI890	DO801 ⁽¹⁾ , DO810 ⁽¹⁾ DO814 ⁽¹⁾ , DO815 ⁽¹⁾ DO820 ⁽¹⁾ , DO821 ⁽¹⁾ DO890 ⁽¹⁾	DP820 ⁽²⁾ INSCANT	DP820 ⁽²⁾ OUT-SCANT
2	16.60%	11.80%	16.60%	16.63%	11.82%	8.40%	8.40%	16.60%	11.80%
4	8.300%	5.900%	8.300%	8.332%	5.923%	4.200%	4.200%	8.300%	5.900%
8	4.150%	2.950%	4.150%	4.182%	2.973%	2.100%	2.100%	4.150%	2.950%
16	2.075%	1.475%	2.075%	2.107%	1.498%	1.050%	1.050%	2.075%	1.475%
32	1.038%	0.738%	1.038%	1.070%	0.761%	0.525%	0.525%	1.038%	0.738%
64	0.519%	0.369%	0.519%	0.551%	0.392%	0.263%	0.263%	0.519%	0.369%
128	0.259%	0.184%	0.259%	0.292%	0.207%	0.131%	0.131%	0.259%	0.184%
256	0.130%	0.092%	0.130%	0.162%	0.115%	0.066%	0.066%	0.130%	0.092%
512	0.065%	0.046%	0.065%	0.097%	0.069%	0.033%	0.033%	0.065%	0.046%
1024	0.032%	0.023%	0.032%	0.065%	0.046%	0.016%	0.016%	0.032%	0.023%
2048	0.016%	0.012%	0.016%	0.049%	0.035%	0.008%	0.008%	0.016%	0.012%
4096	0.008%	0.006%	0.008%	0.041%	0.029%	0.004%	0.004%	0.008%	0.006%

- (1) Readbacks increase the load depending on the cyclicity and with the same amount as the net load at the cycle time. For Master the cycle time is 1024 which gives 0.016% more load. For MOD the cycle time is configurable.
- (2) Total load = (load generated by INSCANT) + (load generated by OUTSCANT)
 The total load if INSCANT is 32 ms and OUTSCANT is 64 ms is:
Total load = 1.038 + 0.369 = 1.407%

7.1.1.3 Calculation of load for AF100 with a length of max 15,000 m (16,400 yards)

Due to the organization of the Advant Fieldbus 100 scans, some constraints are imposed on the transmissions. To guarantee message transfer etc., at least 50% of the fieldbus load is reserved. The remaining load (up to 50%) can be used for S800 I/O Station loading and other station loading.



The calculated load of Advant Fieldbus 100 must be equal to or less than 50%
NOTE! 1 ms cycle time is not allowed.

Table 7-3. % of Load on the Advant Fieldbus 100 by S800 I/O (15,000 m Bus Length)

Cycle Time (ms)	Module Type								
	AI801 AI810 AI890	AI820	AI830 AI835	AO801 AO810 AO890	AO820	DI801, DI810 DI811, DI814 DI820, DI821 DI830, DI831 DI885, DI890	DO801 ⁽¹⁾ , DO810 ⁽¹⁾ DO814 ⁽¹⁾ , DO815 ⁽¹⁾ DO820 ⁽¹⁾ , DO821 ⁽¹⁾ DO890 ⁽¹⁾	DP820 ⁽²⁾ INSCANT	DP820 ⁽²⁾ OUT- SCANT
2	20.60%	15.80%	20.60%	20.64%	15.83%	12.40%	12.40%	20.60%	15.80%
4	10.30%	7.900%	10.30%	10.34%	7.931%	6.200%	6.200%	10.30%	7.900%
8	5.150%	3.950%	5.150%	5.190%	3.981%	3.100%	3.100%	5.150%	3.950%
16	2.575%	1.975%	2.575%	2.615%	2.006%	1.550%	1.550%	2.575%	1.975%
32	1.288%	0.988%	1.288%	1.328%	1.018%	0.775%	0.775%	1.288%	0.988%
64	0.644%	0.494%	0.644%	0.684%	0.525%	0.388%	0.388%	0.644%	0.494%
128	0.322%	0.247%	0.322%	0.362%	0.278%	0.194%	0.194%	0.322%	0.247%
256	0.161%	0.123%	0.161%	0.201%	0.154%	0.097%	0.097%	0.161%	0.123%
512	0.080%	0.062%	0.080%	0.121%	0.093%	0.048%	0.048%	0.080%	0.062%
1024	0.040%	0.031%	0.040%	0.080%	0.062%	0.024%	0.024%	0.040%	0.031%

Table 7-3. % of Load on the Advant Fieldbus 100 by S800 I/O (15,000 m Bus Length)

Cycle Time (ms)	Module Type								
	AI801 AI810 AI890	AI820	AI830 AI835	AO801 AO810 AO890	AO820	DI801, DI810 DI811, DI814 DI820, DI821 DI830, DI831 DI885, DI890	DO801 ⁽¹⁾ , DO810 ⁽¹⁾ DO814 ⁽¹⁾ , DO815 ⁽¹⁾ DO820 ⁽¹⁾ , DO821 ⁽¹⁾ DO890 ⁽¹⁾	DP820 ⁽²⁾ INSCANT	DP820 ⁽²⁾ OUTSCANT
2048	0.020%	0.015%	0.020%	0.060%	0.046%	0.012%	0.012%	0.020%	0.015%
4096	0.010%	0.008%	0.010%	0.050%	0.039%	0.006%	0.006%	0.010%	0.008%

- (1) Readbacks increase the load depending on the cyclicity and with the same amount as the net load at the cycle time. For Master the cycle time is 1024 which gives 0.024% more load. For MOD the cycle time is configurable.
- (2) Total load = (load generated by INSCANT) + (load generated by OUTSCANT)
The total load if INSCANT is 32 ms and OUTSCANT is 64 ms is:
Total load = 1.288 + 0.494 = 1.782%

7.1.2 PROFIBUS

7.1.2.1 Calculation of Number of S800 I/O Modules per Station

Due to the Profibus-DP specification it is not possible to connect 24 analog I/O modules to one FCI. The reason is that the S800 I/O system includes more data and user parameters than PROFIBUS-DP can handle. Table 7-5 shows maximum number of analog modules that can be connected to one CI830.

Table 7-4. Maximum Number of Modules on CI830

Module Type	Number of Modules
AI801, AI810, AI830, AI835, AI890	12
AI820	20
AO801, AO810, AO890	13
AO820	21
DP820	10

In order to find out if a given configuration of analog and digital modules can be used the following method should be used:

- Fill in number of modules in table Table 7-5.
- Calculate the sum in the three columns:
 - Sum User Parameters
 - Sum Input Bytes
 - Sum Output Bytes
- Calculate the three total sums for:
 - ParamSize
 - InSize
 - OutSize
- Check that:
 - ParamSize is less than or equal to 237
 - InSize is less than or equal to 244
 - OutSize is less than or equal to 244

If any of these three values is too high then the configuration can **not** be used.

- Round up the values to the nearest multiple of eight (8), for example, 233 is rounded to 240.
- Finally calculate the memory size with the formula:
$$\text{MemSize} = 672 + 2 \times (8 + \text{RoundParamSize}) + 3 \times (\text{RoundInSize} + \text{RoundOutSize})$$



Check that MemSize is less than or equal to 2048. If not, the configuration can **NOT** be used.

Table 7-5. Calculation of Number of Modules

Module Type	User Parameters	Input Bytes	Output Bytes	Number of Modules	Sum User Parameters	Sum Input Bytes	Sum Output Bytes
CI830	3	4	0	1	3	4	0
AI801	7	20	4				
AI810	11	20	4				
AI820	7	12	4				
AI830	11	20	4				
AI835	13	20	4				
AI890	11	20	4				
AO801	16	4	18				
AO810	16	4	18				
AO820	10	4	10				
AO890	16	4	18				
DI801	4	6	4				
DI810	4	6	4				
DI811	4	6	4				
DI814	4	6	4				
DI820	4	6	2				
DI821	4	6	2				
DI890	4	6	4				
DO801	8	4	4				
DO810	8	4	4				
DO814	8	4	4				
DO815	8	4	4				

Table 7-5. Calculation of Number of Modules (Continued)

Module Type	User Parameters	Input Bytes	Output Bytes	Number of Modules	Sum User Parameters	Sum Input Bytes	Sum Output Bytes
DO820	6	4	4				
DO890	8	4	4				
DP820	14	22	16				
Standard Drives	4	8	6				
Total sum	-	-	-		ParamSize	InSize	OutSize
Rounded sum	-	-	-		Round ParamSize	Round InSize	Round OutSize

7.1.2.2 Calculation of Bus Cycle Time

How to calculate the Bus Cycle Time, see documentation for current master.

To calculate the Bus Cycle Time the following parameters for the I/O station shall be used:

Number of input and output bytes. See Section 7.1.2.1, Calculation of Number of S800 I/O Modules per Station)

MAX T_{SDR} Maximum Station Delay of Responder in T_{BIT} (Bit Time).
 See GSD file.

7.1.3 S800 I/O Station Data Scanning

The ModuleBus data is scanned (read or written) cyclically, depending on the I/O module configuration. To calculate the I/O scan cycle time in the FCI do as follows:

Totalize (number of module type x) times (used execution time for type x) (see Table 7-6) and increase the total value to the nearest higher multiple of two (2) to get the I/O scan cycle time.

Table 7-6. I/O Scan Cycle Time in the FCI

Module Type	Execution Time Used in ms	
	Single FCI CI810, CI810A ⁽¹⁾ , CI830	Redundant FCI CI820
AI801, AI810, AI890	3.75	4.5
AI820	1.88	2.25
AI830, AI835	0.50	0.6
AO801, AO810, AO890	1.50	1.8
AO820	0.75	0.9
DI801, DI810, DI811, DI814, DI820, DI821, DI830, DI831, DI885, DI890	0.54	0.65
DO801, DO810, DO814, DO815, DO820, DO821, DO890	0.54	0.65
DP820	2.15	2.16
FCI = CI810, CI810A ⁽¹⁾ , CI830	1.75	-
FCI = CI820 redundant	-	2.1

(1) If CI810A is used the scan cycle time is increased by 25% and to the next higher multiple of 2.

Analog modules will be scanned every fourth I/O scan cycle time except for AI830 and AI835 modules which will be scanned every tenth time.
DI and DO modules will be scanned each I/O scan cycle time.

For example, a non redundant station with CI810A, two AI810, one AO810, two DI810, two DO820 and one AI830 will give the following I/O scan cycle time:

2 AI810 => 2*3.75 =	7.50
1 AO810 => 1*1.50 =	1.50
2 DI810 => 2*0.54 =	1.08
2 DO810 => 2*0.54 =	1.08
1 AI830 =>1*0.50 =	0.50
1 CI810A => 1*1.75 =	1.75

13.41+ (nearest higher value dividable by 2) =	14 ms

That will give an I/O scan cycle time of 14 ms between the FCI and its I/O modules. This means that the DIs and DOs will be scanned every 14 ms, the AI810s and the AO810 every (4*14 ms) 56 ms and the AI830 every (10*14 ms) 140 ms.



Minimum I/O scan cycle time = 4 ms single FCI.
 Minimum I/O scan cycle time = 6 ms redundant FCI.

7.1.4 Power Supply and Cooling Requirements

A quick guide for power consumption to be used in a preliminary phase of a project work or whenever you need estimated figures is provided in Table 7-7.

Table 7-7. Estimated System Power Consumption

S800 I/O Station	24V d.c. Power Consumption (A)
Base cluster, single FCI, with six (6) I/O Modules	0.5
Base cluster, single FCI, with twelve (1)2 I/O Modules	1.0
Base cluster, redundant FCIs (2), with six (6) I/O Modules	1.0
Base cluster, redundant FCIs (2), with twelve (1) 2 I/O Modules	1.5
Additional I/O cluster with six (6) I/O Modules	0.5
Additional I/O cluster with twelve (12) I/O Modules	1.0



The estimates are based on fully loaded I/O Stations with a mixed configuration of DI/DO and AI/AO.

Only power distributed via the Modulebus are included. External 24V connected directly to the I/O modules for external loads and transmitters are not included.

When using AO820 and/or DO820/DO821, these load figures may be exceeded and a load calculation can be useful to do, see Table 7-8

Power and Cooling

Table 7-8 shows the typical power and cooling values that can be used when designing the S800 I/O.

Table 7-8. I/O Station Power and Cooling (Typical Values)

Device	5 Volts ModuleBus	24 Volts ModuleBus	24 Volts External	Power Dissipation (Watts)	Cooling Load ⁽¹⁾ (BTU/H Typical)	Maximum Ambient Temperature
AI801	70 mA		30 mA	1.1	3.7	55/40°C (131/104°F) ⁽²⁾
AI810	70 mA	40 mA	-	1.5	5.1	55/40°C (131/104°F) ⁽²⁾
AI820	80 mA	70 mA	-	1.7	5.8	55/40°C (131/104°F) ⁽²⁾
AI830	80 mA	80 mA	-	2.2	7.5	55/40°C (131/104°F) ⁽²⁾
AI835	75 mA	50 mA	-	1.6	5.4	55/40°C (131/104°F) ⁽²⁾
AI890	70 mA	-	200 mA	1.5	5.1	55/40°C (131/104°F) ⁽²⁾
AO801	70 mA		200 mA	3.8	13	55/40°C (131/104°F) ⁽²⁾
AO810	70 mA	-	200 mA	3.0	10	55/40°C (131/104°F) ⁽²⁾
AO820	100 mA	200 mA	-	2.8	9.6	55/40°C (131/104°F) ⁽²⁾
AO890	70 mA	-	200 mA	3.1	10	55/40°C (131/104°F) ⁽²⁾
DI801	70 mA	-	-	2.2	7.5	55/40°C (131/104°F) ⁽²⁾
DI810	50 mA	-	-	1.8	6.1	55/40°C (131/104°F) ⁽²⁾
DI811	50 mA	-	-	2.7	9.2	55/40°C (131/104°F) ⁽²⁾

Table 7-8. I/O Station Power and Cooling (Typical Values) (Continued)

Device	5 Volts ModuleBus	24 Volts ModuleBus	24 Volts External	Power Dissipation (Watts)	Cooling Load ⁽¹⁾ (BTU/H Typical)	Maximum Ambient Temperature
DI814	50 mA	-	-	1.8	6.1	55/40°C (131/104°F) ⁽²⁾
DI820	50 mA	-	-	2.8	9.6	55/40°C (131/104°F) ⁽²⁾
DI821	50 mA	-	-	2.8	10	55/40°C (131/104°F) ⁽²⁾
DI830	120 mA	-	-	2.3	7.8	55/40°C (131/104°F) ⁽²⁾
DI831	120 mA	-	-	3.2	11	55/40°C (131/104°F) ⁽²⁾
DI885	160 mA	91 mA ⁽³⁾	91 mA ⁽³⁾	3.0	10	55/40°C (131/104°F) ⁽²⁾
DI890	50 mA	-	50 mA	1.4	5.7	55/40°C (131/104°F) ⁽²⁾
DO801	70 mA	-	⁽⁴⁾	2.1	7.2	55/40°C (131/104°F) ⁽²⁾
DO810	80 mA	-	⁽⁴⁾	2.1	7.2	55/40°C (131/104°F) ⁽²⁾
DO814	80 mA	-	⁽⁴⁾	2.1	7.2	55/40°C (131/104°F) ⁽²⁾
DO815	130 mA	-	2 A ⁽⁵⁾	4.0	14	55/40°C (131/104°F) ⁽²⁾
DO820	60 mA	140 mA	-	2.9	9.9	55/40°C (131/104°F) ⁽²⁾
DO821	60 mA	140 mA	-	2.9	9.9	55/40°C (131/104°F) ⁽²⁾
DO890	80 mA	-	250 mA	4.4	15	55/40°C (131/104°F) ⁽²⁾
DP820	120 mA	-	⁽⁴⁾	2.5	8.5	55/40°C (131/104°F) ⁽²⁾
CI810	-	-	110 mA	2.6	8.9	55°C/(131°F)
CI820	-	-	250 mA ⁽⁶⁾	6.0	20	55°C/(131°F)
CI830	-	-	110 mA	2.6	8.9	55°C/(131°F)
TB810	100 mA	20 mA	-	0.5	1.7	55°C/(131°F)
TB811	100 mA	20 mA	-	0.5	1.7	55°C/(131°F)
TB820	-	-	100 mA	2.4	8.2	55°C/(131°F)

Table 7-8. I/O Station Power and Cooling (Typical Values) (Continued)

Device	5 Volts ModuleBus	24 Volts ModuleBus	24 Volts External	Power Dissipation (Watts)	Cooling Load ⁽¹⁾ (BTU/H Typical)	Maximum Ambient Temperature
SD811	-	-		11	37	55°C/(131°F) ⁽⁷⁾
SD812	-	-		22	75	55°C/(131°F) ⁽⁷⁾

- (1) Cooling load is the heat (BTU/H) produced by the equipment that may be required to meet room or enclosure cooling specifications.
- (2) 40°C (104°F) applies to Compact MTUs with I/O modules mounted on a vertical DIN rail.
- (3) 24V from ModuleBus (91 mA) or 24V external (91 mA) or 48V external (22 mA).
- (4) 500 mA per channel with maximum load per channel.
- (5) 2A per channel with maximum load per channel.
- (6) C1820 in redundant configuration 2 x 250 mA
- (7) Horizontal mounting only.

Calculation of 24V d.c. Power Consumption

Total 24V d.c. power consumption = Σ 24V load ModuleBus + Σ 5V load ModuleBus*0.3 + Σ 24V external load.



The calculated 24 V ModuleBus load should not exceed 1.3 A.

7.2 I/O Module MTU Combination and Key Setting

Each MTU is used with certain types of I/O Modules. Refer to Table 7-9 and Table 7-10 for a cross-reference between MTU and I/O Modules. Each MTU has two mechanical keys that have to be set for the type of I/O module that will be installed on it.

Table 7-9. MTU Usage and Key Settings

Module Type	TU810 TU812 TU814 Compact	TU811 Compact	TU830 Extended	TU831 Extended	TU835 Extended	TU836 TU837 Extended	TU838 Extended	Mech. Key Setting	
								Key 1	Key 2
AI810	X	-	X	-	X	-	X	A	E
AI820	X	-	X	-	-	-	-	B	B
AI830	X	-	X	-	-	-	-	A	F
AI835	X	-	X	-	-	-	-	B	A
AO810	X	-	X	-	-	-	-	A	E
AO820	X	-	X	-	-	-	-	B	C
DI810	X	-	X	-	-	-	X	A	A
DI811	X	-	X	-	-	-	X	B	D
DI814	X	-	X	-	-	-	X	B	E
DI820	-	X	-	X	-	-	-	A	B
DI821	-	X	-	X	-	-	-	A	C
DI830	X	-	X	-	-	-	X	A	A
DI831	X	-	X	-	-	-	X	B	D
DI885	X	-	X	-	-	-	-	B	F
DO810	X	-	X	-	-	-	-	A	A
DO814	X	-	X	-	-	-	-	B	E
DO815	X ⁽¹⁾	-	X	-	-	-	-	A	A
DO820	-	X	-	X	-	X	-	A	D
DO821	-	X	-	X	-	X	-	C	A
DP820	X	-	X	-	-	-	-	C	B

(1) TU812 can only be used for 5A per group of channels. Propriate cable must be used.

Table 7-10. MTU Usage and Key Settings for Intrinsic Safety interfacing units

Module Type	TU890 Compact	Mech. Key Setting ⁽¹⁾	
		Key 1	Key 2
AI890	X	A	C
AO890	X	A	D
DI890	X	A	A
DO890	X	A	B

(1) Note that the shape and style of key on the TU890 MTU is different from the standard MTU's.

7.3 Supported I/O Modules and Drives via Advant Fieldbus 100

The Advant Fieldbus 100 Field Communication Interface module CI810 and CI820 support all S800 I/O modules, standard and engineered drives.

7.4 Supported I/O Modules and Drives via PROFIBUS

The following I/O modules are supported by the PROFIBUS Field Communication Interface module CI830:

- AI801, AI810, AI820, AI830, AI835, AI890
- AO801, AO810, AO820, AO890
- DI801, DI810, DI811, DI814, DI820, DI821, DI890
- DO801, DO810, DO814, DO815, DI820, DO821, DO890
- DP820
- Standard Drives

7.5 Intrinsic Safety Parameters

The following Intrinsic Safety parameters apply for AI890 Table 7-11, AO890 Table 7-12, DI890 Table 7-13 and DO890 Table 7-14.

Table 7-11. AI890 Analog Input Module Intrinsic Safety Parameters

Terminals	Safety description	Maximum external parameters				
		Groups CENELEC USA		C ₀ (uF)	L ₀ (mH)	L/R (uH/O)
Powered transmitter terminals	U ₀ = 27 V	IIC	AB	0.097	4.1	58
	I ₀ = 93 mA	IIB	CE	0.74	16.5	230
	P ₀ = 620 mW	IIA	DFG	2.51	33	470
Passive input terminals ⁽¹⁾	U ₀ = 1.2 V	IIC	AB	-	-	-
	I ₀ = 50 mA	IIB	CE	-	-	-
	P ₀ = 25 mW	IIA	DFG	-	-	-

(1) Non energy-storing apparatus connection

Table 7-12. AO890 Analog Output Module Intrinsic Safety Parameters

Terminals	Safety description	Maximum external parameters				
		Groups CENELEC USA		C ₀ (uF)	L ₀ (mH)	L/R (uH/O)
Powered output terminals	U ₀ = 27 V	IIC	AB	0.097	4.1	58
	I ₀ = 93 mA	IIB	CE	0.74	16.5	230
	P ₀ = 620 mW	IIA	DFG	2.51	33	470

Table 7-13. DI890 Digital Input Module Intrinsic Safety Parameters

Terminals	Safety description	Maximum external parameters				
		Groups CENELEC USA		C ₀ (uF)	L ₀ (mH)	L/R (uH/O)
Input terminals	U ₀ = 11V	IIC	AB	1.97	80	595
	I ₀ = 21 mA	IIB	CE	13.8	320	2382
	P ₀ = 0.058 mW	IIA	DFG	60	640	4765

Table 7-14. DO890 Digital Input Module Intrinsic Safety Parameters

Terminals	Safety description	Maximum external parameters				
		Groups CENELEC USA		C ₀ (uF)	L ₀ (mH)	L/R (uH/O)
Powered output terminals	U ₀ = 26 V	IIC	AB	0.099	4.1	58
	I ₀ = 93 mA	IIB	CE	0.77	16.4	234
	P ₀ = 605 mW	IIA	DFG	2.6	32.8	469

Chapter 8 Ordering

S800 I/O is ordered as separate parts. From the current price list you order the modules you need for your system.

Please see the valid *S800 I/O System Price List*.

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