



# R-Series

## REDUNDANT I/O MODULES

- Increases system availability and safety of industrial processes
- Allows that signals of conventional input and outputs can be installed and configured in redundant mode
- Guaranteed availability, bumpless
- Low power consumption
- Racks without active components



To meet the requirements for fault tolerance, system availability and safety in the industrial process, the DFI302 controllers work with a Hot Standby redundancy strategy, where all the levels, including conventional Input and Outputs signals, may be configured and installed in a redundant manner.

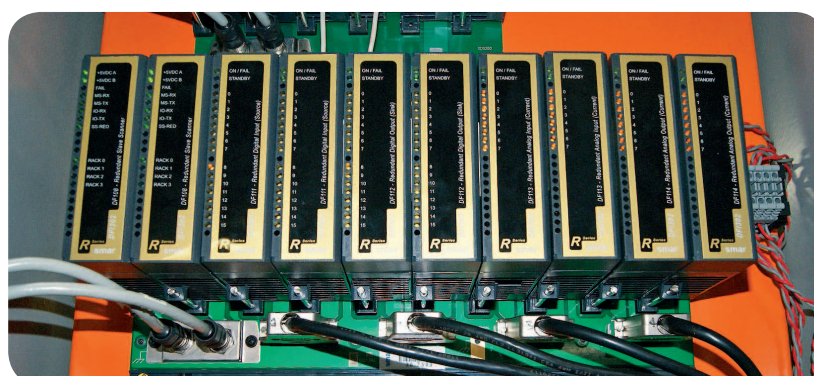
In this strategy, the Primary and the Secondary controllers are connected to a set of redundant I/O scanners, which are dedicated to read and write the redundant I/O cards. The complete path from sensor until operation station is totally redundant. In case of one fault, an event will alarm the user, and the availability will be granted in a bumpless way.

The following components are necessary to build R-Series I/O Redundancy in DFI302.

Racks and Accessories	
DF106	Master Rack - 6 slots for I/O redundancy
DF110-1	Slave Rack - 10 slots for I/O redundancy - Terminal blocks
DF110-2	Slave Rack - 10 slots for I/O redundancy - Interface cabling
DF109	Thin stub cable (0,40m)
DF119	Thick cable (1,0m) for DF106-DF109 or DF106-DF110
Scanners	
DF107	Master Scanner for I/O Redundancy
DF108	Slave Scanner for I/O Redundancy
I/O Modules	
DF111	1 Group of 16 Redundant Digital Inputs 24 Vdc - Source
DF112	1 Group of 16 Redundant Digital Outputs 24 Vdc - Sink
DF113	1 Group of 8 Redundant Current Analog Inputs
DF114	1 Group of 8 Redundant Current Analog Outputs

The following components may complement R-Series IO Redundancy in DFI302.

Code	Description
DF87	Power Supply for Backplane 20-30VDC (5A, Advanced Diagnostic)
DF0-R	Box Used In Empty Slots
ITF-CR-10 ITF-CR-15 ITF-CR-20 ITF-CR-25 ITF-CR-30 ITF-CR-35 ITF-CR-40 ITF-CR-45 ITF-CR-50	Interface cabling (1 m to 5 m)
ITF-DIG	Passive Interface Panel for 16 Digital Input and/or Output Module - DC Obs. The active components must be external connected
ITF-AN-IOR	Interface Panel for 8 Analog Input and/or Output Module Obs. Exclusive for R-Series



In order to have a true Conventional I/O redundant system, all parts and paths must be redundant. The hardware topology for Input and Output Redundant segments based on DF1302 controllers can be seen in the following figure. The system supports up to 16 pairs of R-Series I/O modules. This means 128 analog or 256 discrete I/O values, or a mix of them.

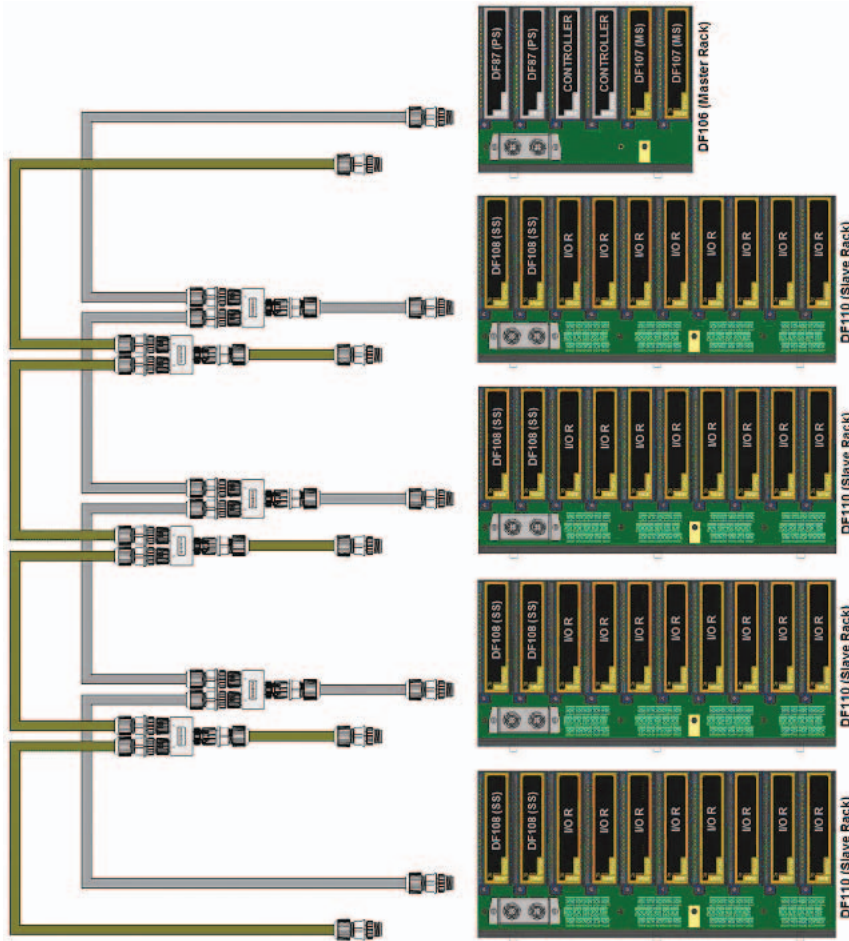


Figure - I/O Redundant System Overview

The SYSTEM302 software logic tool, LogicView for FFB, select the IO redundancy option during hardware configuration phase, and after that, no extra configuration is need once the I/O redundancy is totally transparent to the control logic perspective.

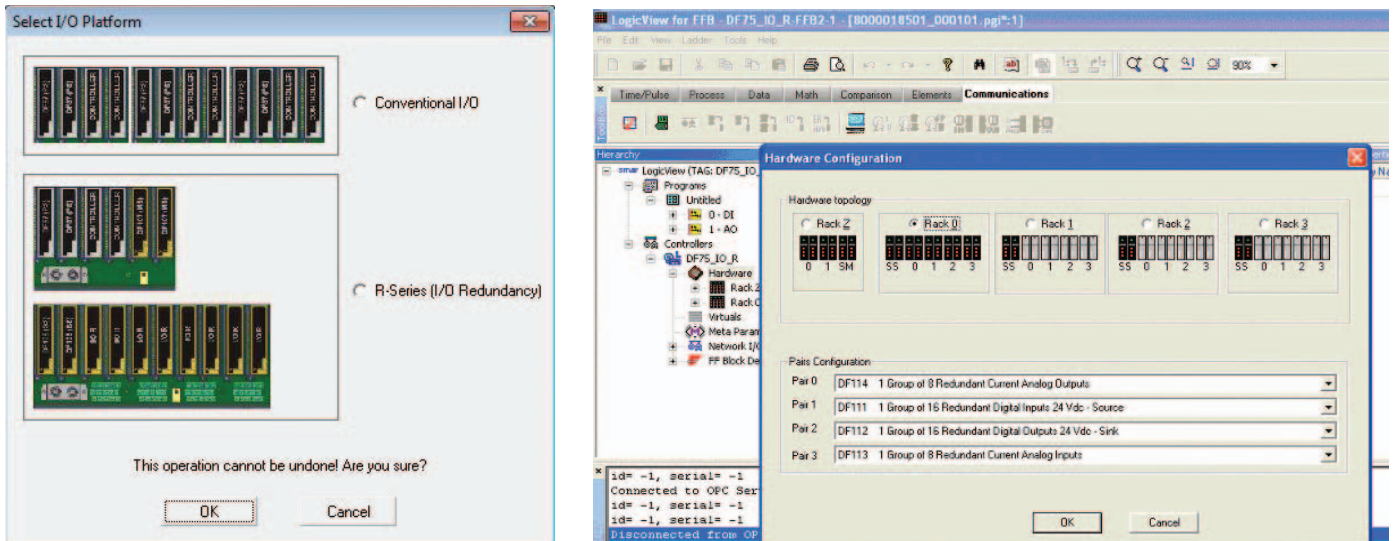


Figure - Configuring redundant I/O modules on LogicView for FFB



Each pair of redundant I/O modules checks the health of each other, working in an independent manner ahead of the main controller scan and grants the switchover in less than 100 microseconds. In case of a fault in the primary I/O module, the secondary I/O module takes the control ensuring that the digital field instruments remain powered and that the process is undisturbed.

No single point of failure exists on this architecture, which means that any hardware failure is covered by a second hardware working in a hot standby way. During operation, each I/O module makes use of an internal high precise reference which is used for analog I/O cards to self-diagnostic. The output I/O card also makes use of a digital feedback circuitry to make sure its output matches the main controller request.

Scanners continually measure the health of each I/O modules to update the main controllers. The main controllers may use the status of the I/O modules in the control logic as safety interlock and provide the same rich information to HMI Stations.

The diagnostic status for the whole system is available, as OPC and Simple Network Management Protocol (SNMP) parameters, available to HMI stations through its respective servers.

When maintenance is needed, the system permits hot swap of the modules, including power supplies, controllers, scanners and I/O modules.

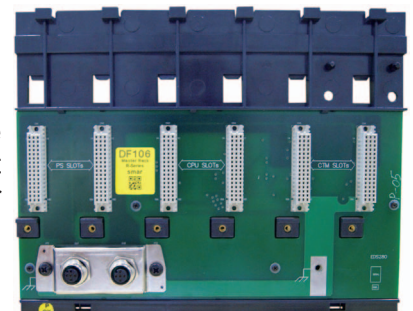
The racks were built to avoid any kind of maintenance. No active component is mounted in this rack.

## Technical Specifications

### Racks

#### DF106 - The Master Rack

The Master Rack (DF106) was built to avoid any kind of maintenance. No active component is mounted in this rack. It is possible to connect one pair of redundant power supplies, one pair of redundant controllers and one pair of redundant master scanners.

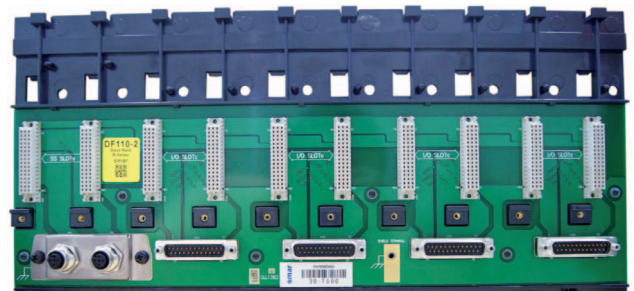
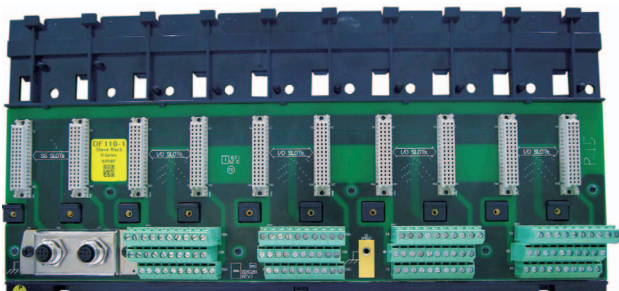


#### DF110 - The Slave Rack

The Slave Rack (DF110) was built to avoid any kind of maintenance. No active component is mounted in this rack. It is possible to connect one pair of redundant slave scanners and up to four pairs of redundant I/O modules per slave rack. Four slave racks is the maximum per master rack.

Two DF110 models are available:

- DF110-1 (Terminal blocks)
- DF110-2 (Interface cabling)



## Scanners

### DF107 - The Master Scanner

Additional to redundant power supplies and controllers, the Master Scanner (DF107) is necessary to support conventional I/O in a redundant way. Connected to a passive rack (DF106), these master scanners will grant access to up to four redundant I/O racks (DF110).



### DF108 - The Slave Scanner

Using a double path, through DF109 and DF119 cables, the pair of Slave Scanners (DF108) is connected to Master Scanners (DF107), and grant real time access to until 16 pairs of I/O modules.



Up to 4 DF110-x (slave racks) may be used in the R-Series system where the slave rack address is internally adjusted via DIP switches in the DF108 (slave scanners) modules. Necessarily the DF108 pair located in the same rack must have the same address.

An additional mechanical keying was added in the DF108 modules as a way to avoid that during maintenance process, the DF108 modules position is changed between slave racks.

## Redundant Input and Output modules

These modules are designed to be used together with Redundant I/O Rack (DF110), supporting redundancy, hot swap and diagnostic.

### DF111 - Redundant Digital Input Module - DC (Source)

This module provides 16 digital inputs (DC type SOURCE) and converts them into a True (ON) or False (OFF) logic signals. It has one group optically isolated from IMB.



Architecture	
Number of Inputs	16
Number of Groups	1
Number of Inputs per Group	16

Isolation	
Between Group and IMB	5000 Vrms

Internal Power	
Provided by the IMB	5 Vdc
Maximum Consumption	80 mA

External Power	
Power Supply (VEXT)	20 - 30 Vdc
Typical Consumption per module	160 mA @ 24Vdc and all channels activated (ON)

Inputs	
ON State Voltage Range (Logic "1")	0 - 5 Vdc @ Zload < 200 Ω
OFF State Voltage Range (Logic "0")	20 - 30 Vdc @ Zload >10 KΩ
Typical Current per Point	8 mA @ 24 Vdc

Dissipated Power	
Typical per Module	4.24 W @ 24Vdc and all channels activated (ON)

Temperature	
Operation	0 °C to 60 °C (32 °F to 140 °F)

Dimensions	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5mm 1.57 x 5.39 x 5.57 in

**DF112 - Redundant Digital Output Module - DC (SINK)**

This module provides 16 digital outputs (DC type SINK) that are able to drive loads with up to 100 mA per output. It has one group optically isolated from IMB.



Architecture	
Number of Outputs	16
Number of Groups	1
Number of Outputs per Group	16

Isolation	
Between Group and IMB	5000 Vrms

Internal Power	
Provided by the IMB	5 Vdc
Maximum Consumption	80 mA

External Power	
Power Supply (VEXT)	20 - 30 Vdc
Typical Consumption per module	180 mA @ 24Vdc and all channels activated (ON)

Outputs	
Maximum Switched Voltage	30 Vdc
Maximum Current per Output	100 mA
Indicator Logic	ON when the transistor is conducting.

Dissipated Power	
Typical per Module	4.72 W @ 24Vdc and all channels activated (ON)

Temperature	
Operation	0 °C to 60 °C (32 °F to 140 °F)

Dimensions	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5mm 1.57 x 5.39 x 5.57 pol

### DF113 - Redundant Analog Input Module - Current

This module provides 8 current analog inputs. The inputs are individually configured to read 0 to 20 mA or 4 to 20 mA. The group is isolated from IMB.



Architecture	
Number of Inputs	8
Number of Groups	1
Number of Inputs per Group	8

Isolation	
Between Group and IMB	5000 Vrms

Internal Power	
Provided by the IMB	5 Vdc
Maximum Consumption	80 mA

External Power	
Power Supply (VEXT)	20 - 30 Vdc
Typical Consumption per module	60 mA @ 24Vdc and 20 mA in all channels

Inputs	
Inputs Type	Single Ended (1 ground)
Typical Impedance per Point	250 Ω

Inputs Range	Range 1	Range 2
Current Input	4 mA to 20 mA	0 mA to 20 mA

A/D Conversion	
Resolution	16 bits

Dissipated Power	
Typical per Module	2.78 W @ 24Vdc and 20 mA in all channels

Temperature	
Operation	0 °C a 60 °C (32 °F to 140 °F)

Dimensions	
Dimensões (W x D x H)	39.9 x 137.0 x 141.5mm 1.57 x 5.39 x 5.57 in

**DF114 - Redundant Analog Output Module - Current**

This module provides 8 current analog outputs. The current outputs can be configured individually on ranges 0 to 20 mA, 0 to 21 mA or 4 to 20 mA. The group is optically isolated from IMB.



Architecture	
Number of Outputs	8
Number of Groups	1
Number of Outputs per Group	8

Isolation	
IBetween Group and IMB	5000 Vrms

Internal Power	
Provided by the IMB	5 Vdc
Maximum Consumption	80 mA

External Power	
Power Supply (VEXT)	20 - 30 Vdc
Typical Consumption per Module	270 mA @ 24Vdc and 21 mA in all channels

Outputs	
Outputs Type	Single Ended (1 ground)
Impedance per Point*	750 Ω @ > 24 Vdc

Outputs Range	Range 1	Range 2	Range 3
Current Output	4 mA to 20 mA	0 mA to 20 mA	0 mA to 21 mA

D/A Conversion	
Resolution	12 bits

Dissipated Power	
Typical per Module	6.88 W @ 24Vdc and 21 mA in all channels

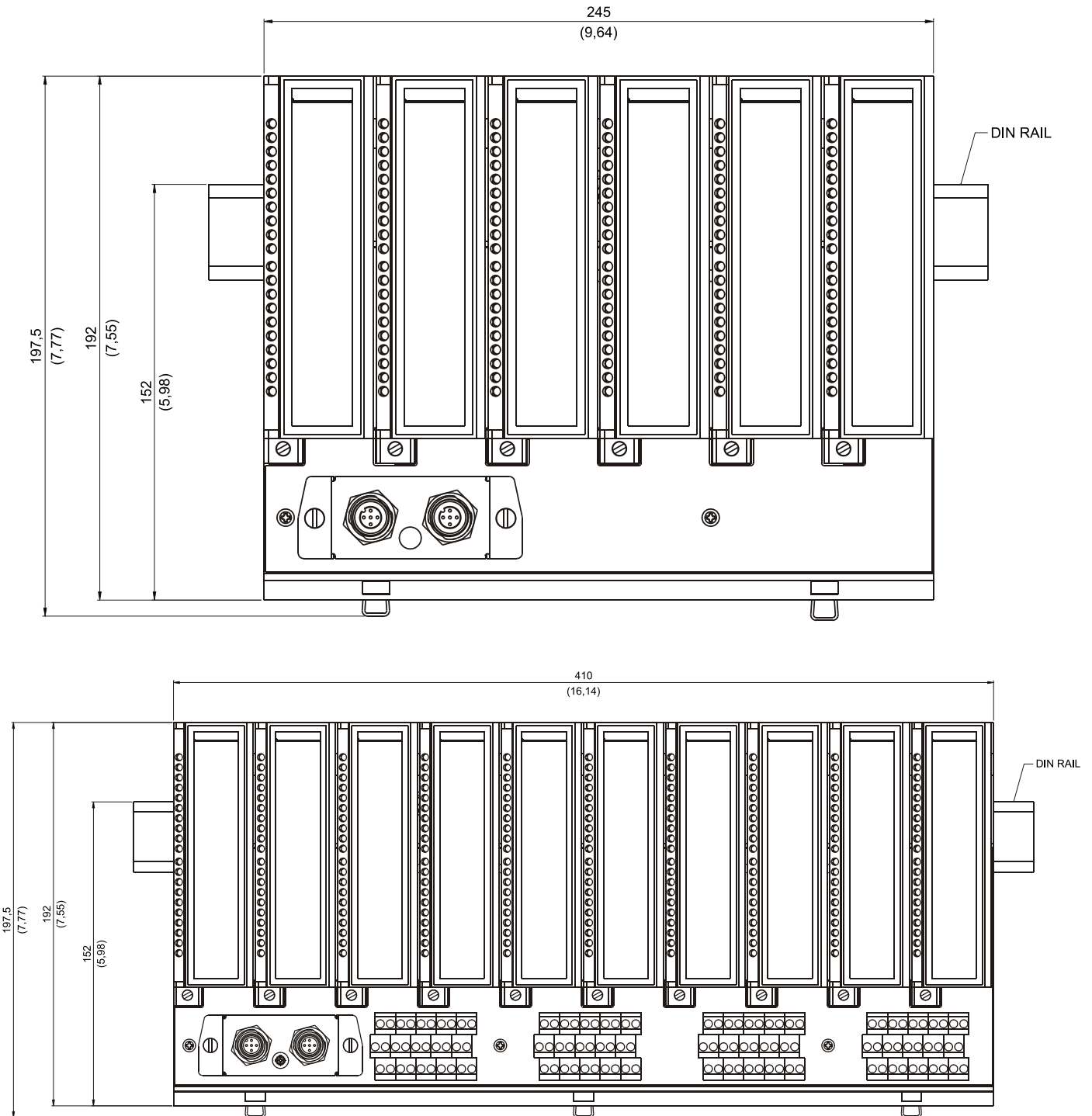
\* - With the channel equivalent impedance at around 550 Ω, the operation voltage can vary between 20 and 30 V.  
 - When there is a need to get the best module accuracy, particularly at high temperatures, it is required that the minimum equivalent impedance of the channel is 750 Ω. For this, it may be necessary to add a residual resistor in series in each channel. In this case, it will be necessary that the operation voltage is equal or greater than 24 V.

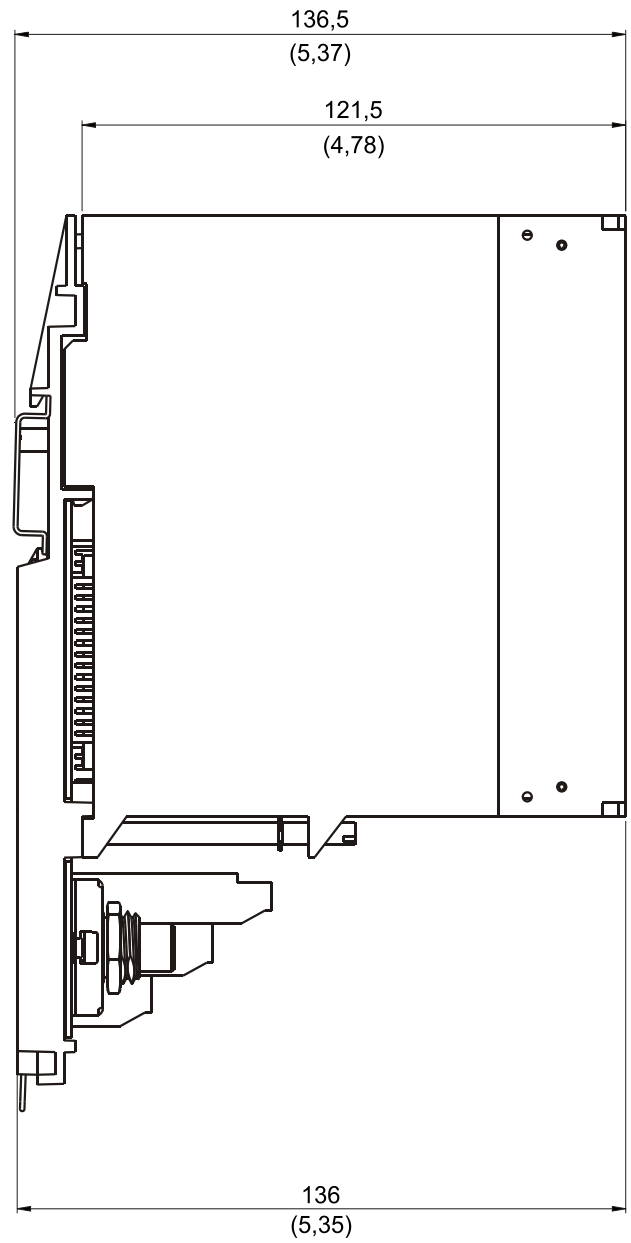
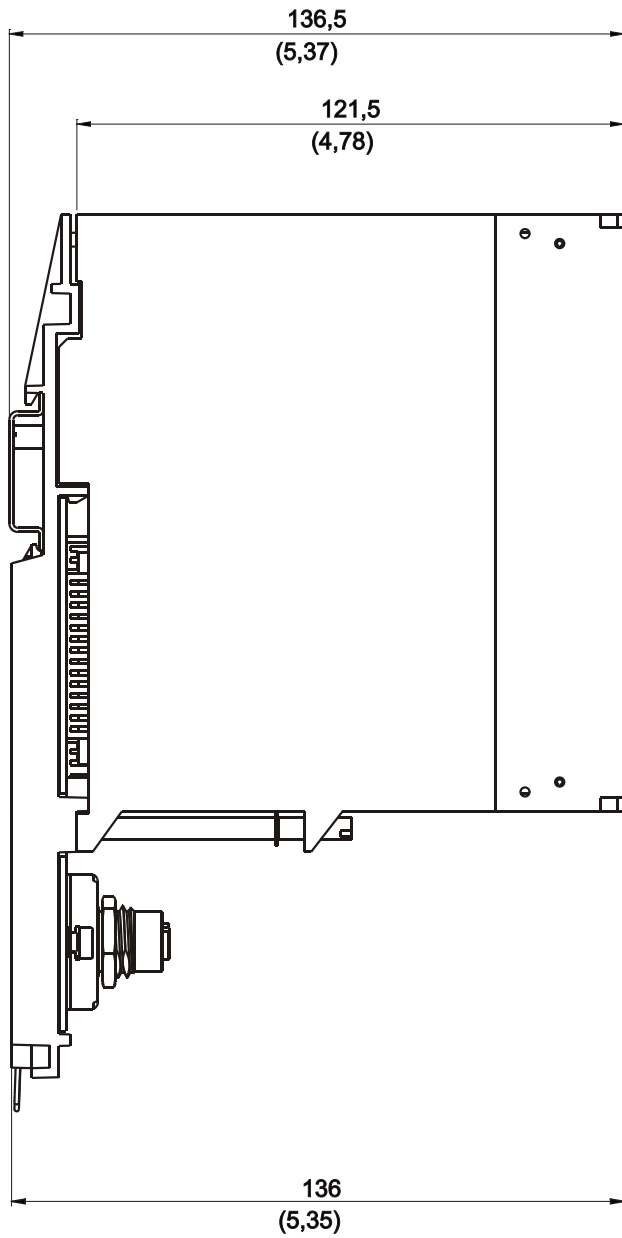


Temperature	
Operation	0 °C to 60 °C (32 °F to 140 °F)

Dimensions	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5mm 1.57 x 5.39 x 5.57 in

## Dimensional Drawings





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