

DeviceNet Safety

DST1-ID12SL-1 Safety Input Terminal

**DST1-MD16SL-1 Safety I/O Terminal
with Semiconductor Outputs**

**DST1-MRD08SL-1 Safety I/O Terminal
with Relay Outputs**

DST1-series

Safety I/O Terminals

OPERATION MANUAL

OMRON

DST1-series Safety I/O Terminals Operation Manual

Revised February 2006

Notice

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual. The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

	DANGER	Indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or may result in death. Additionally, there may be severe property damage.
	WARNING	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury or may result in serious injury or death. Additionally, there may be severe property damage.
	CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
	Indicates required actions.	
	Indicates prohibited actions.	

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “PLC” means Programmable Controller. “PC” is used, however, in some Programming Device displays to mean Programmable Controller.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

IMPORTANT Indicates important information on what to do or not to do to prevent failure to operation, malfunction, or undesirable effects on product performance.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1,2,3... Indicates lists of one sort or another, such as procedures, checklists, etc.

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About this Manual

This manual describes the installation and operation of a DST1-series Safety I/O Terminals (referred to as the DST1 in this manual).

Please read this manual carefully and be sure you understand the information provided before attempting to install or operate the DST1. Be sure to read the precautions provided in the following section.

The following manuals provide information on the DeviceNet and DeviceNet Safety.

Manual	Products	Contents	Cat. No.
DeviceNet Safety DST1-series Safety I/O Terminals Operation Manual (This manual)	DST1-series Safety I/O Terminals	Information on DST1-series Safety I/O Terminals	Z904
DeviceNet Safety System Configuration Manual	WS02-CFSC1-E	Information on using the Network Configurator	Z905
DeviceNet Operation Manual	Describes the network configuration and connection modes of a DeviceNet network. Also provides details on connection methods, specifications, and power supply methods to the communications systems of connection devices, such as cables and connectors.		W267



WARNING

Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

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Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Precautions

1 Intended Audience

This manual is intended for the following personnel, who must have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing FA and safety systems into production facilities
- Personnel in charge of designing FA and safety systems
- Personnel in charge of managing FA facilities
- Personnel who have the qualifications, authority, and obligation to provide safety during each of the following product phases: mechanical design, installation, operation, maintenance, and disposal

2 General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

WARNING

It is extremely important that a PLC and all PLC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PLC System to the above-mentioned applications.

WARNING

This is the Operation Manual for the DST1-series Safety I/O Terminals. Heed the following items during system construction to ensure that safety-related components are configured in a manner that allows the system functions to sufficiently operate.

● Risk Assessment

The proper use of the safety device described in this Operation Manual as it relates to installation conditions and mechanical performance and functions is a prerequisite for its use. When selecting or using this safety device, risk assessment must be conducted with the aim of identifying potential danger factors in equipment or facilities in which the safety device is to be applied, during the development stage of the equipment or facilities. Suitable safety devices must be selected under the guidance of a sufficient risk assessment system. An insufficient risk assessment system may lead to the selection of unsuitable safety devices.

- Typical related international standards: ISO 14121, Safety of Machinery -- Principles of Risk Assessment

● Safety Measures

When using this safety device to build systems containing safety-related components for equipment or facilities, the system must be designed with the full understanding of and conformance to international standards, such as those listed below, and/or standards in related industries.

- Typical related international standards: ISO/DIS 12100, Safety of Machinery -- Basic Concepts and General Principles for Design
IEC 61508, Safety Standard for Safety Instrumented Systems (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems)

● Role of Safety Device

This safety device is provided with safety functions and mechanisms as stipulated in relevant standards, but suitable designs must be used to allow these functions and mechanisms to operate properly inside system constructions containing safety-related components. Build systems that enable these functions and mechanisms to perform properly, based on a full understanding of their operation.

- Typical related international standards: ISO 14119, Safety of Machinery -- Interlocking Devices Associated with Guards -- Principles of Design and Selection

● Installation of Safety Device

The construction and installation of systems with safety-related components for equipment or facilities must be performed by technicians who have received suitable training.

- Typical related international standards: ISO/DIS 12100, Safety of Machinery -- Basic Concepts and General Principles for Design
IEC 61508, Safety Standard for Safety Instrumented Systems (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems)

● Complying with Laws and Regulations

This safety device conforms to the relevant regulations and standards, but make sure that it is used in compliance with local regulations and standards for the equipment or facilities in which it is applied.

- Typical related international standards: IEC 60204, Safety of Machinery -- Electrical Equipment of Machines

● Observing Precautions for Use

When putting the selected safety device to actual use, heed the specifications and precautions in this Operation Manual and those in the Instruction Manual that comes with the product. Using the product in a manner that deviates from these specifications and precautions will lead to unexpected failures in equipment or devices, and to damages that result from such failures, due to insufficient operating functions in safety-related components.

● Moving or Transferring Devices or Equipment

When moving or transferring devices or equipment, be sure to include this Operation Manual to ensure that the person to whom the device or equipment is being moved or transferred will be able to operate it properly.

- Typical related international standards: ISO/DIS 12100 ISO, Safety of Machinery -- Basic Concepts and General Principles for Design IEC 61508, Safety Standard for Safety Instrumented Systems (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems)

3 Safety Precautions

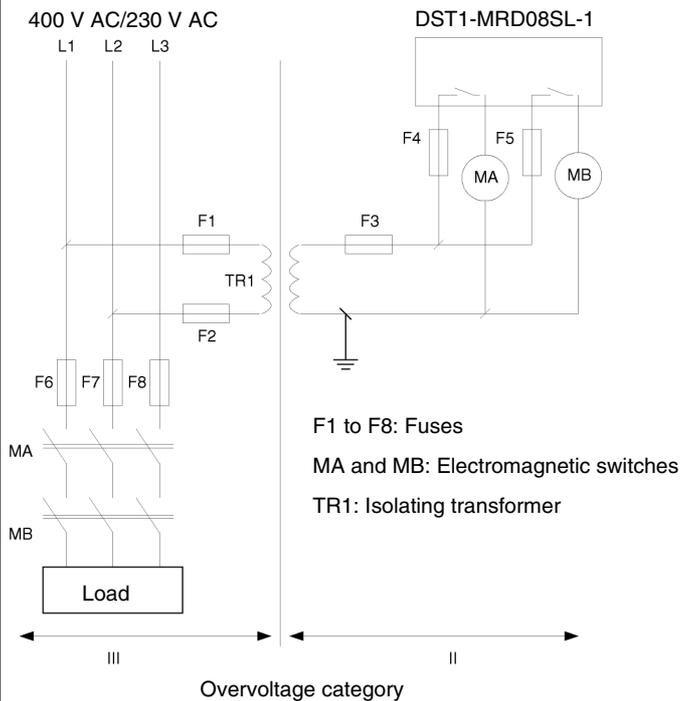
 WARNING	
<p> Serious injury may possibly occur due to loss of required safety functions. Do not use test outputs of the DST1 as any safety outputs.</p>	
<p> Serious injury may possibly occur due to loss of required safety functions. Do not use DeviceNet standard I/O data or Explicit message data as any safety data.</p>	
<p> Serious injury may possibly occur due to loss of required safety functions. Do not use LEDs on the DST1 for safety operations.</p>	
<p> Serious injury may possibly occur due to breakdown of safety outputs. Do not connect loads beyond the rated value to the safety outputs.</p>	
<p> Serious injury may possibly occur due to loss of required safety functions. Wire the DST1 properly so that DC24V line do NOT touch the safety outputs accidentally or unintentionally.</p>	
<p> Serious injury may possibly occur due to loss of required safety functions. Ground the 0V line of the power supply for external output devices so that the devices do Not turn ON when the safety output line is grounded.</p>	

Precautions

For the DST1-MRD08SL-1, isolating transformers, such as TR1, that are used to isolate between overvoltage categories III and II must conform to IEC60742, and the insulation between the primary input and secondary output must satisfy at least the basic insulation standards of overvoltage category III.

One side of the secondary output of the isolating transformer must be grounded to prevent electrical shock in case of short-circuiting to the ground or to the frame of the isolating transformer.

To protect the isolating transformer and to prevent electrical shock in case of short-circuiting to the frame, insert fuses according to transformer specifications, i.e. at points F1, F2, and F3.



Serious injury may possibly occur due to loss of required safety functions. Clear the previous configuration data before connecting devices to the network.



Serious injury may possibly occur due to loss of required safety functions. Set suitable node addresses before connecting devices to the network.



Serious injury may possibly occur due to loss of required safety functions. Perform user testing and confirm that all device configuration data and operations are correct before starting system operation.



Serious injury may possibly occur due to loss of required safety functions. When replacing a device, configure the replacement device appropriately and confirm that it operates correctly.



For Model DST1-MRD08SL-1, insert a fuse rated at 3.15A or less for each output terminal to protect safety output contacts from welding. Confirm the fuse selection with the fuse manufacturer to ensure the dependability of the characteristics of the connected load.



Serious injury may possibly occur due to loss of safety functions. Use appropriate devices according to the requirements given in the following table.



Control device	Requirements
Emergency stop switches	Use approved switches with a direct opening mechanism complying with IEC/EN 60947-5-1.
Door interlocking switches Limit switches	Use approved switches with a direct opening mechanism complying with IEC/EN 60947-5-1 and capable of switching micro-loads of 5 mA at 24 V DC.
Safety sensors	Use approved sensors complying with the relevant product standards, regulations, and rules in the country where it is used.
Relays with forcibly guided contacts Contactors	Use approved relays with forcibly guided contacts complying with EN 50205. For feedback purpose, use devices with contacts capable of switching micro-loads of 5 mA at 24 V DC.
Other devices	Evaluate whether devices used are appropriate to satisfy the requirements of safety category.

4 Precaution for Safe Use

- Handle with care
Do not drop the DST1 to the ground or excessive vibration or mechanical shocks. The DST1 may be damaged and may not function properly.

- Installation and storage environment
Do not use or store the DST1 in any of the following locations.
 - Locations subject to direct sunlight.
 - Locations subject to temperatures or humidity outside the range specified in the specifications.
 - Locations subject to condensation as the result of severe changes in temperature.
 - Locations subject to dust (especially iron dust) or salts
 - Locations subject to dust (especially iron dust) or salts.
 - Locations subject to water, oil, or chemicals.
 - Locations subject to shock or vibration.
 Take appropriate and sufficient countermeasures when installing systems in the following locations. Inappropriate and insufficient measures may result in malfunction.
 - Locations subject to static electricity or other forms of noise.
 - Locations subject to strong electromagnetic fields
 - Locations subject to possible exposure to radioactivity.
 - Locations close to power supplies.

- Installation/ Mounting
 - Use the DST1 within an enclosure with IP54 protection or higher of IEC/EN 60529.
 - Use DIN rail (TH35-7.5 according to IEC60715) for placing the DST1 into the control board.
 - Mount the DST1 to DIN rails with attachments (TYPE PFP-M, not incorporated to this product), not to drop out of rails by vibration etc.
 - Spacing should be available around the DST1 at least 50mm from its top and bottom surfaces for ventilation and wiring.

Precautions

- Installation/ Wiring

- Use the following to wire external I/O devices to the DST1.

Solid wire	0.2 ~ 2.5 mm ² AWG 24 ~ 12
Standard (Flexible) wire	0.34 ~ 1.5 mm ² AWG 22 ~ 16 Standard wire should be processed with insulation-covered bar terminal (DIN46228-4 standard compatible type) at its ends before using for connection.

- Disconnect the DST1 from power supply when wiring. Devices connected to DST1 may operate unexpectedly.
- Apply properly specified voltages to the DST1 inputs. Applying inappropriate DC voltage and any AC voltages cause the DST1 to fail.
- Be sure to separate the communication cable and the I/O cable from the high-voltage/ current lines.
- Be cautious not to have your fingers caught when attaching connectors to the plugs on the DST1.
- Mount screw of DeviceNet Connector and I/O Connector correctly.(0.25-0.3N•m)
- Incorrect wiring may lead to loss of safety function. Wire conductors correctly and verify the operation of the DST1 before commissioning the system in which DST1 is incorporated.
- After wiring is completed, be sure to remove label for wire clipping prevention on the DST1 to enable heat to escape for proper cooling

- Power Supply Selection

Use DC power supply satisfying requirements below.

- Secondary circuits of DC power supply is isolated from its primary circuit by double insulations or reinforced insulations
- DC power supply satisfies the requirement for class 2 circuits or limited voltage/current circuit stated in UL 508.
- 20ms or over of the output hold time.

- Periodical Inspection and Maintenance

- Disconnect the DST1 from power supply when replacing. Devices connected to the DST1 may operate unexpectedly.
- Do not dismantle, repair, or modify the DST1. It may lead to loss of its safety functions.

- Disposal

- Be cautious not to have you injured when dismantling the DST1.

5 Additional Precautions According to UL1604

DST1-ID12SL-1 and DST1-MD16SL-1 are suitable for use in Class I, Div. 2, Group A, B, C, D or Non-Hazardous Location Only.

WARNING – Explosion Hazard – Substitution of Components May Impair Suitability For Class I, Div. 2.

WARNING – Explosion Hazard – Do not Disconnect Equipment Unless Power Has Been Switched Off Or The Area Is Known To Be Non-Hazardous.

6 Regulation and Standards

The DST1-series Safety I/O Terminals has been certified as follows by TUV Rheinland:

1. European Standards

EN 954-1/12.96

EN 60204-1/12.97

EN 61000-6-2/10.01

EN 61000-6-4/10.01

EN 418/1992

2. International Standards

IEC 61508 part1-7/12.98-05.00

IEC 61131-2/02.03

3. U.S.A. Standards

NFPA 79-2002

ANSI RIA15.06-1999

ANSI B11.19-2003

The DST1 has been certified as follows by Underwriter's Laboratory:

- Listings for U.S. and Canadian Safety Standards

UL1998

NFPA 79

UL 508

CSA 22.2 No14

UL 1604 (For Model DST1-ID12SL-1 and Model DST1-MD16SL-1)

Glossary

Term	Description
idle data	Data sent when the originating application is in an inexecutable state.
assembly	Internal data in a device gathered as one group to be accessed externally.
safety data	Data with high reliability.
error latch time	The time period to hold an error state (control data, status data, and LED indications).
open type	The open method for Safety Connection. One of three types is selected in the settings of a connection to the Safety Master.
connection	A logical communications path used to communicate between devices.
configuration	The settings for a device and a network.
single channel	Using only one input or output as the input or output.
standard	A device or device function to which safety measures are not applied.
safety controller (safety PLC)	A controller with high reliability used for the safety control.
safety chain	The logical chain to actualize a safety function, that consists of the input device (sensor), the control device (including a remote I/O device), and the output device (actuator).
safety protocol	The communications hierarchy added to actualize highly reliable communications.
safety signature	A certificate of the configuration data issued to a device from the Network Configurator. The device verifies that the configuration data is correct by using the safety signature.
test pulse	A signal used to detect external wiring coming into contact with the power supply (positive) or short circuits between signal lines.
dual channel	Using two inputs or outputs as the input or output for redundancy.
Dual Channel Complementary	Setting to evaluate that two logic states are complementary.
Dual Channel Equivalent	Setting to evaluate that two logic states are equivalent.
Busoff	Status that occurs when the error rate is extremely high over a communications cable. An error is detected when the internal error counter exceeds a certain threshold value. (The internal error counter is cleared when the Master is started or restarted.)
DeviceNet Safety	A safety network that adds a safety protocol to DeviceNet to comply with IEC61508 SIL3, EN954-1 Safety Category 4.
discrepancy time	The time period from a change in one of two inputs until the other input changes.
EPI	The interval of safety data communications between the Safety Master and the Safety Slave.
multi-cast connection	Safety I/O communications in a 1:n configuration (n = 1 top 15).
single-cast connection	Safety I/O communications in 1:1 configuration .
TUNID	The UNID of the local node. Usually the TUNID is set from the Network Configurator.
UNID	A identifier to specify one device in all the network domains. Values combining the network address and the node address are used.

Revision History

The manual revision is indicated at the end of the Cat. No. printed at the lower left of back cover of the manual.

Cat. No.	Z904-E1-02
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Revision

Revision	Date	Modifications
01	April 2005	First edition
02	February 2006	<p>Page 9: Precautions added.</p> <p>Pages 9, 5-12: Information added on isolating transformers.</p> <p>Pages 3-7, 3-8: Information added on I/O data supported by Safety I/O Terminals.</p> <p>Page 5-9: Changes made to safety output specifications.</p> <p>Page 6-2: Changes made to indicators and error processing table.</p> <p>Pages 6-3 to 6-5: Changes made to troubleshooting tables.</p> <p>Pages 6-6, 6-7: Changes made to error history table.</p>

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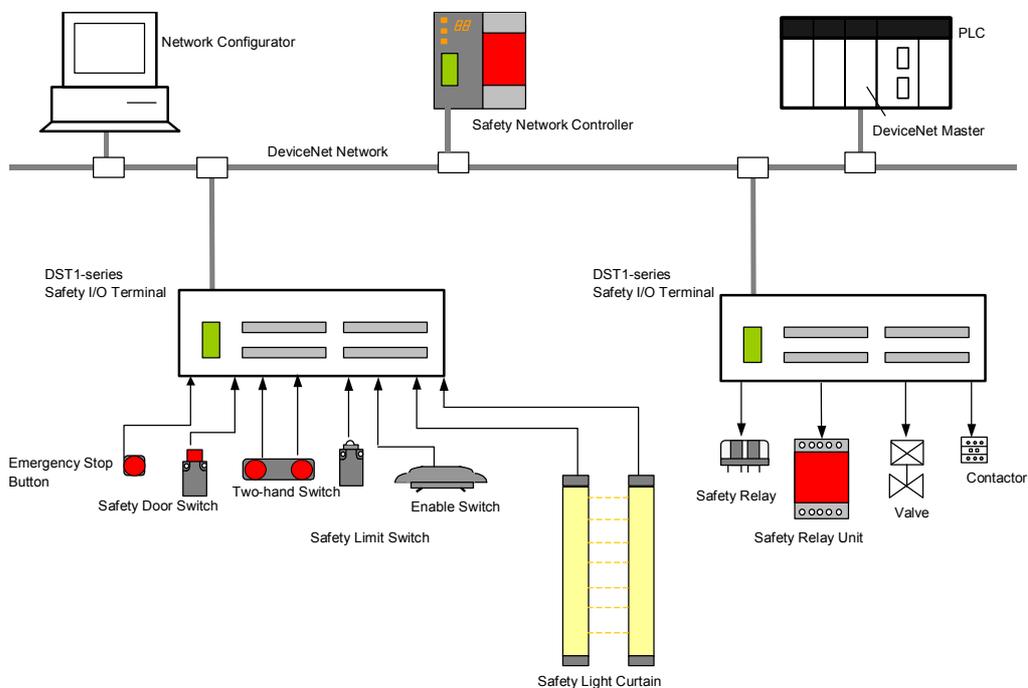
Section 1 Overview

1-1 Overview

1-1-1 About the DST1-series Safety I/O Terminals

The DST1-series Safety I/O Terminals support the DeviceNet Safety protocol and provide various functions for the Safety System. The DST1-series Safety I/O Terminals allow the user to construct a safety control/network system that meets the requirements for Safety Integrity Level (SIL) 3 according to IEC 61508 (Functional Safety of Electrical/Electronic/ Programmable Electronic Safety-related Systems) and the requirements for Safety Category 4 according to EN 954-1.

The DST1-series Safety I/O Terminal's safety I/O data is transmitted through safety I/O communications conforming to the DeviceNet Safety Protocol, and the data processing is performed in conducted in the Safety Network Controller (NE1A-SCPU01). Also, the status of the safety I/O data can be monitored in a standard PLC in an existing DeviceNet network using standard I/O communications or explicit message communications.



1-1-2 DST1-series Safety I/O Terminals Features

Safety Inputs

- Semiconductor output devices such as light curtains can be connected as well as contact output devices such as emergency stop switches.
- Faults in external wiring can be detected.
- Input delays (ON delays and OFF delays) can be set.
- Pairs of related local inputs can be set to Dual Channel Mode in order to be compliant with the Category 4 standards.
When Dual Channel Mode is set, the input data patterns and the time discrepancy between input signals can be evaluated.

Test Outputs

- 4 independent test outputs are available to use.
- A disconnected external indicator lamp can be detected. (Can be set for the T3 Terminal only.)
- Test outputs can be used as power supply terminals to devices such as sensors.
- Test outputs can be used as the standard output terminals for monitor outputs.

Safety Outputs

Semiconductor Outputs

- Pairs of related local outputs can be set to Dual Channel Mode in order to be compliant with the Category 4 standards.
When Dual Channel Mode is set, the output data patterns can be evaluated.
- The rated output current is 0.5 A max. per output.

Relay Outputs

- Pairs of related output terminals can be set to Dual Channel Mode in order to be compliant with the Category 4 standards.
When Dual Channel Mode is set, the output data patterns can be evaluated.
- The rated output current is 2 A max. per output.
- The safety relays can be replaced.

DeviceNet Safety Communications

As a Safety Slave, the DST1-series Safety I/O Terminals can perform safety I/O communications with up to four connections.

DeviceNet Standard Communications

As a Standard Slave, the DST1-series Safety I/O Terminals can perform standard I/O communications with one Standard Master with up to two connections.

System Startup and Error Recovery Support

- Error information can be checked by using the error log function or the indicators on the front of the DST1-series Safety I/O Terminals.
- The DST1-series Safety I/O Terminal's safety I/O data and internal status information can be monitored from a Standard PLC by allocating the information in the standard Master. In the same way, the information can be monitored from a safety PLC by allocating the information in the Safety Master.

Access Control with a Password

The DST1-series Safety I/O Terminals configuration data is protected by a password.

I/O Connector Connection/Disconnection

- The I/O Connector can be connected and disconnected.
- The I/O Connector is structured to prevent incorrect connection.

Cage Clamp Wiring

Cables can be wired without terminal screws.

Maintenance Functions

The DST1-series Safety I/O Terminals are equipped with Maintenance Functions such as a contact operation counter, cumulative ON time monitor, and operating time monitor.

1-2 Standard Models

The following table shows the three models of DST1-series Safety I/O Terminals that are available: the Safety Input Terminal, Safety I/O Terminal (Semiconductor Output), and Safety Input/Output Terminal (Relay Output).

Model	Name	I/O capacity			
		Safety inputs	Test outputs	Safety outputs	
				Semiconductor outputs	Relay outputs
DST1-ID12SL-1	Safety Input Terminal	12 inputs	4 outputs (See note.)	-	-
DST1-MD16SL-1	Safety I/O Terminal with Semiconductor outputs	8 inputs	4 outputs (See note.)	8 outputs	-
DST1-MRD08SL-1	Safety I/O Terminal with Relay Outputs	4 inputs	4 outputs (See note.)	-	4 outputs

Note: Each test output can be set to function as a test output or a standard output. Test outputs are used in combination with a safety input. Broken wires in an external indicator can be detected for terminal T3 only.

1-3 Functions

1-3-1 DST1-series Safety I/O Terminals

Item	Description			
Self-diagnosis functions	Self-diagnosis is performed when power is turned ON and periodically during operation. When an error occurs, it is treated as a fatal error, the MS indicator will light in red, and all safety outputs and output data to the network will turn OFF.			
Access Control by Password	After configuration data has been downloaded and verified, configuration data within the DST1-series Safety I/O Terminals can be protected by a password.			
Automatic baud rate detection	The DST1-series Safety I/O Terminals is automatically set to the baud rate of the network.			
Contents of remote I/O communications	I/O data for control	Safety Inputs	The ON/OFF status of each safety input terminal	DST1→ DeviceNet Master Safety Master
		Safety Outputs	The ON/OFF status of each safety output terminal	Safety Master → DST1
		Standard Outputs	The ON/OFF status of each test output terminal (T0 to T3)	DeviceNet Master or Safety Master→ DST1
	Output monitors	Safety Output Monitors	The actual ON/OFF status of each safety output	DST1→ DeviceNet Master Safety Master
	Status data	Individual Safety Input Status	Normal flag for each safety input	
		Combined Safety Input Status	Common normal flag that is ON when the all safety inputs are normal	
		Individual Safety Output Status	Normal flag for each safety output	
		Combined Safety Output Status	Common normal flag that is ON when the all safety outputs are normal	
		Individual Test Output Status	Normal flag for each test output	
		Muting Lamp Status	Normal flag for test output for terminal T3 when set as muting output	
General status data	Indicates the general status of the DST1-series Safety I/O Terminals by using the following 8 flags. Bit 0: Safety Input Power Status Flag Bit 1: Safety Output Power Status Flag Bit 2: Network Power Voltage Drop Flag Bit 3: Unit Maintenance Flag Bit 4: (Reserved) Bit 5: Combined I/O Port Status Flag Bit 6: Operation Time Exceeded Flag Bit 7: Connected Component Maintenance Flag		DST1→ DeviceNet Master	
No. of connections	Safety I/O	4 (Single-cast and Multi-cast) (See note.)		
	Standard I/O	2 (Poll, Bit-Strobe, COS, and Cyclic)		

IMPORTANT Communications with up to 15 Safety Controllers for each connection can be performed using multi-cast connection. If four connections are used, however, only a maximum of 30 Safety Controllers total can communicate with the DST1-series Safety I/O Terminals.

Item	Description	
Allocation patterns of remote I/O communications	DST1-ID12 SL-1	For remote I/O communications, the user can select and allocate the following I/O data, for which there are 15 patterns when combined: - I/O data for control - Status data - General status data Refer to <i>Section 3-2</i> .
	DST1-MD16 SL-1	For remote I/O communications, the user can select and allocate the following I/O data, for which there are 16 patterns when combined: - I/O data for control - Status data - General status data - Output monitors Refer to <i>Section 3-2</i> .
	DST1-MRD08 SL-1	For remote I/O communications, the user can select and allocate the following I/O data, for which there are 16 patterns when combined: - I/O data for control - Status data - General status data - Output monitors Refer to <i>Section 3-2</i> .
Smart slave functions	Network power supply voltage monitor	The present, bottom, and peak values of the network power voltage can be recorded in the DST1. A monitor voltage (default setting: 11 V) can be set in the DST1 and the Network Power Voltage Drop Flag in the general status data will turn ON when the voltage drops below the set monitor value.
	Unit conduction time monitor	The total ON time (unit: 0.1 hrs) of the DST1's internal circuit power can be calculated and recorded. A monitor value can be set in the DST1 and the Unit Maintenance Flag in the general status data will turn ON when the total time reaches the set monitor value.
	Unit Name	The user can assign and record a name or comment for every DST1 (up to 32 characters). These terminal names/comments can be read and written.
	I/O comments	The user can assign a name for each I/O contact on the DST1 (up to 32 characters each) and record it in the DST1. The connected device can be checked for each I/O contact, allowing faulty devices to be identified during remote maintenance.
	Last maintenance date	The date on which maintenance was last performed can be written in the DST1. This means that the timing for future maintenance can be judged more easily.
	I/O power status monitor	This function is used to detect whether the I/O power is ON. When the I/O power supply is turned OFF, the Safety Input Power Status Flag or Safety Output Power Status Flag in the general status data turns ON.
	Contact operation counters	Contact operation counters are used to count the number of times each input or output contact changes from OFF to ON (maximum resolution of 50 Hz) and record the total values in the DST1.
	Total ON time monitors	The total ON time for each I/O contact can be calculated (unit: s) and recorded in the DST1. Monitor values can be set in the DST1, and when the set number of operations is reached, the Connected Component Maintenance Flag in the general status data turns ON.
Operation time monitor	The operation time monitor can measure the time from when an output contact goes ON to when the input contact goes ON (unit: ms) and record the time in the DST1.	
Error history	Error status information for the last ten errors that occurred are recorded in the DST1. The Network Configurator can be used to read the error history.	

1-3 Functions

1-3-2 Safety Inputs

Item	Description	
Input channel mode	Any of the following four modes can be selected according to the external input device for each input.	
	Not Used	The safety input is not used. (External input device not connected.)
	Test Pulse from Test Output	Specifies connecting a device with a contact output in combination with a test output. When this mode is selected, select the test output to use for the test source and then set the test output mode to <i>Pulse Test Output</i> . When these settings are made, contact between the input signal line and the power supply (plus) and short circuits with other input signal lines can be detected.
	Used as Safety Input	Specifies connecting a safety device with a semiconductor output, such as a light curtain.
	Used as Standard Input	Specifies connecting a standard device (i.e., a non-safety device).
Dual channel mode	The consistency between signals on two channels can be evaluated. Any of the following settings can be selected. The discrepancy time is set at the same time.	
	Single Channel	Specifies using Single Channel Mode. If <i>Single Channel</i> is selected, the safety input that would be paired for the dual channel parameter will also be set to Single Channel Mode.
	Dual Channel Equivalent	Specifies using the Dual Channel Equivalent Mode with a paired safety input.
	Dual Channel Complementary	Specifies using Dual Channel Complementary Mode with a paired safety input.
	Discrepancy Time	This setting is used to monitor the time in discrepancies in the logic between two channels set as <i>Dual Channel Equivalent</i> or <i>Dual Channel Complementary</i> .
Input delays	ON Delay	An input signal is treated as being OFF during the ON delay setting time (0 to 126 ms, in increments of 6 ms) after the input contact's rising edge. The input will turn ON only if the input contact remains ON after the ON delay time has elapsed. This helps prevent chattering of the input contacts.
	OFF Delay	An input signal is treated as being ON during the OFF delay setting time (0 to 126 ms, in increments of 6 ms) after the input contact's falling edge. The input will turn OFF only if the input contact remains OFF after the OFF delay time has elapsed. This helps prevent chattering of the input contacts.
Input error latch time	The OFF status is held for at least the input error latch time (0 to 65,530 ms, in increments of 10 ms) when the individual safety input status turns OFF.	

1-3-3 Test Outputs

Item	Description	
Test output mode	Any of the following five modes can be selected according to the external input device.	
	Not Used	The corresponding test output is not used.
	Standard Output	Specifies connecting to the input for a muting lamp or PLC. Used as a monitor output.
	Pulse Test Output	Specifies connecting a device with a contact output in combination with the safety input.
	Power Supply Output	Specifies connecting to the power supply terminal of a safety sensor. The voltage supplied from the test output to the I/O power supply (V, G) is output.
Muting Lamp Output (terminal T3 only)	Specifies a muting lamp output. When the output is ON, disconnection of the muting lamp can be detected.	
Output status after communications error	Sets the output state of the test output when a communications error occurs. This parameter is enabled when the Test Output Channel Mode is set to <i>Standard Output</i> or <i>Muting Lamp Output</i> .	
Short-circuit detection	Supported.	
Broken wire detection of external indicator	Supported. This setting is valid when Test Output Mode is set to <i>Muting Lamp Output</i> .	

1-3 Functions

1-3-4 Safety Outputs

Item	Description	
Output channel mode	Any of the following three modes can be selected according to the external input device.	
	Not Used	The safety output is not used. (External output device not connected.)
	Safety	Specifies not outputting the test pulse when the output is ON. Contact between the output signal line and the power supply (positive) when the output is OFF and ground faults can be detected.
	Safety Pulse Test	Outputs the test pulse when the output is ON. Contact between the output signal line and the power supply, and short circuits with other output signal lines can be detected.
Dual channel mode	The consistency between signals on two channels can be evaluated. Either of the following settings can be selected.	
	Single Channel	Specifies using Single Channel Mode. When <i>Single Channel</i> is set, the safety output that would be paired for the dual channel parameter is also set to Single Channel Mode.
	Dual Channel	Specifies using Dual Channel Mode. When both of the safety outputs to be paired are normal, the outputs can be turned ON.
Output error latch time	The OFF status is held for at least the output error latch time (0 to 65,530 ms, in increments of 10 ms) when the individual safety output status turns OFF.	
Short-circuit detection	Supported.	
Overcurrent detection	Supported.	

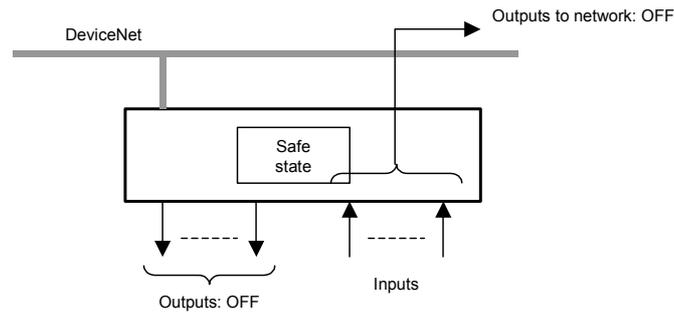
1-4 Description of Safety Functions

1-4-1 DST1-series Safety I/O Terminals

Safe State

The following status is treated as the safe state by the DST1-series Safety I/O Terminals.

- Safety outputs: OFF
- Output data to network: OFF



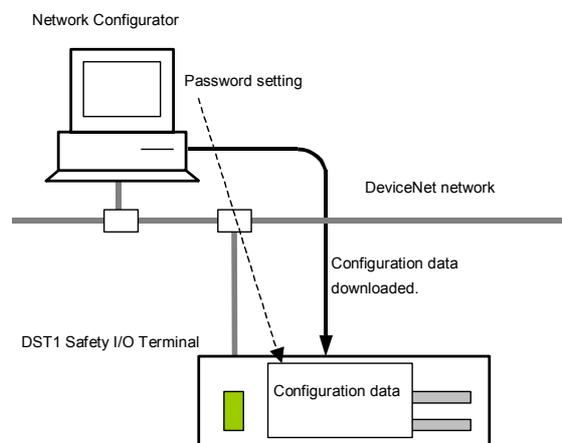
Therefore, the DST1-series Safety I/O Terminals must be used for applications in which it enters into safe state when the safety outputs turn OFF and the output data to the network turns OFF.

Self-diagnosis Functions

Self-diagnosis is performed when the power is turned ON and periodically during operation. If an error occurs, it will be treated as a fatal error (the MS indicator will light in red), and the safety outputs and output data to the network will turn OFF.

Access Control by Password

After configuration data had been downloaded and verified, the configuration data within the DST1-series Safety I/O Terminals can be protected by a password.



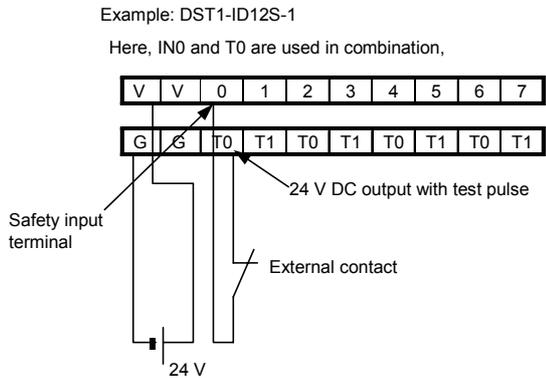
Note: Refer to the *System Configuration Manual (Z905)* for password setting.

1-4 Description of Safety Functions

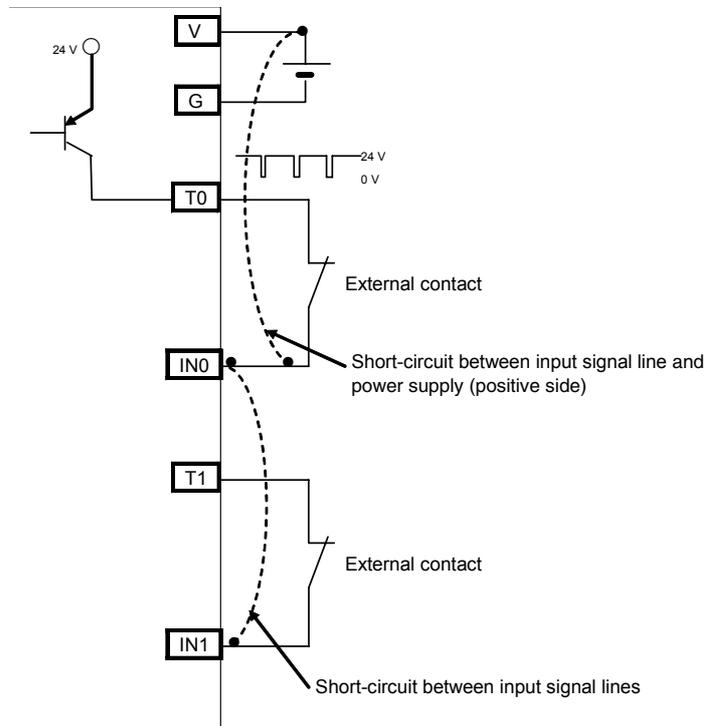
1-4-2 Safety Inputs

Test Pulse from Test Output

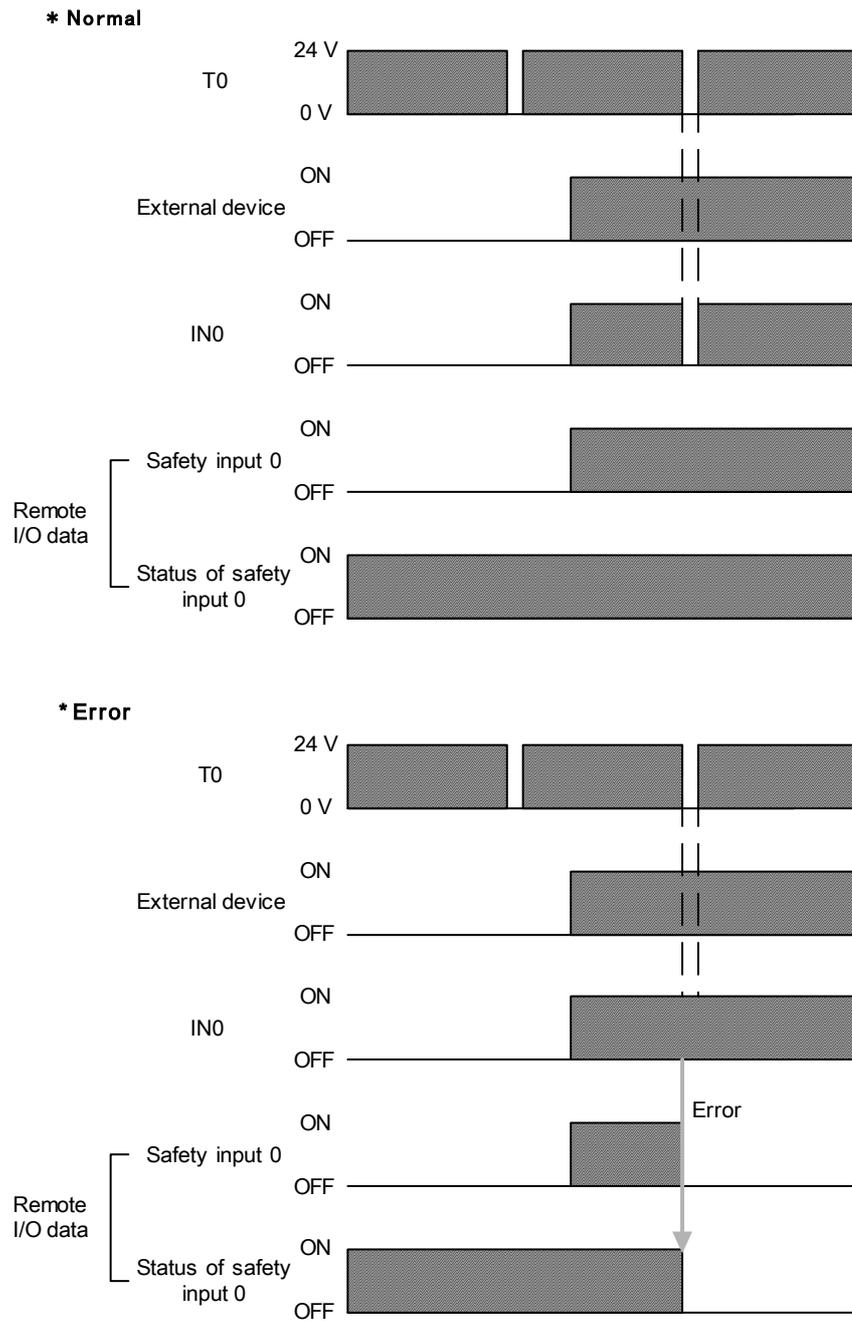
A test output is used in combination with a safety input. Specify the corresponding test output terminal to use as the test source. The test output terminal is used as a power supply to connect an external input device to the safety input terminal.



A test pulse is output from the test output terminal to diagnose the internal circuit when the external input contact turns ON. Using this function, short-circuits between input signal lines and the power supply (positive side), and short-circuits between input signal lines can be detected.



If an error is detected, safety input data and individual safety input status will turn OFF.



Setting Dual Channel Mode and Discrepancy Time

The consistency between signals on two channels can be evaluated. Either of the following settings can be selected. This function monitors the time during which there is a discrepancy in the logic between the two channels set as dual channels. If the length of the discrepancy exceeds the set discrepancy time (0 to 65,530 ms, in increments of 10 ms), the safety input data and the individual safety input status will turn OFF for both inputs.

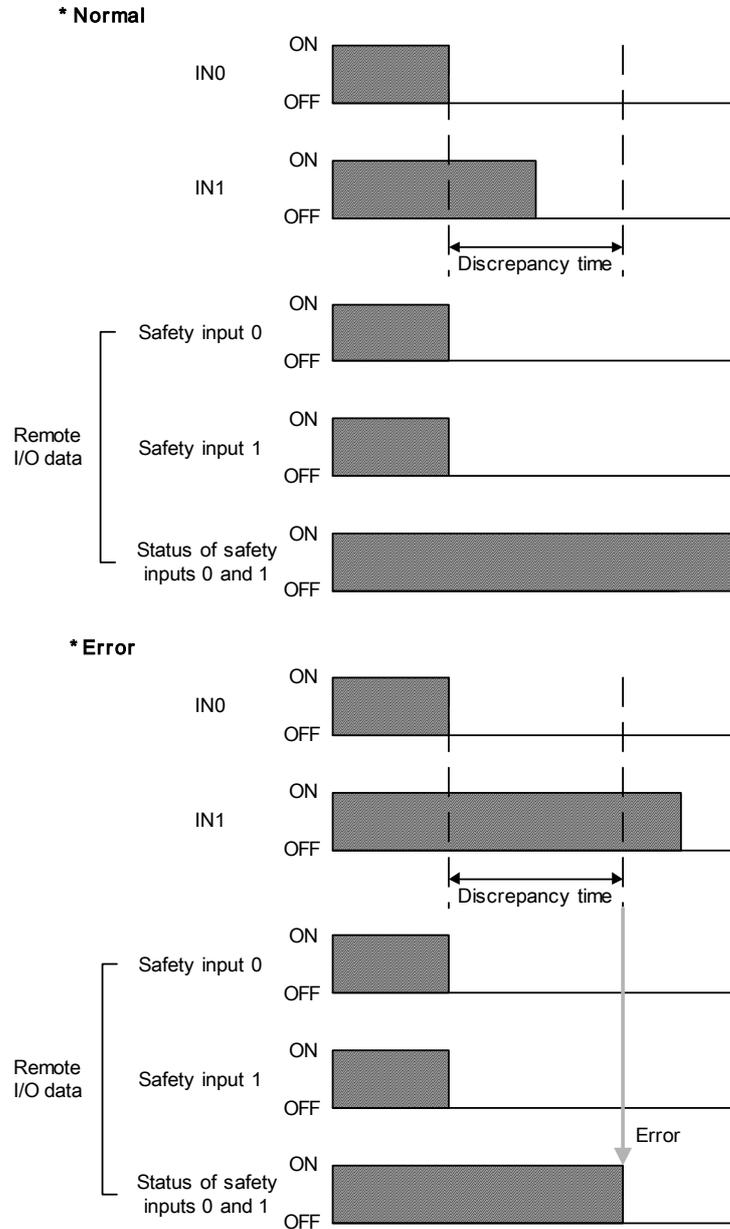
IMPORTANT The dual channel function is used with 2 consecutive inputs that start from even input numbers: inputs 0 and 1, inputs 2 and 3, inputs 4 and 5, etc.

The following table shows the relation between terminal input and remote I/O data.

Dual channel mode	Input terminals		Remote I/O data		Meaning of data
	IN0	IN1	Safety input 0	Safety input 1	
Dual Channel Equivalent	0	0	0	0	OFF
	0	1	0	0	OFF
	1	0	0	0	OFF
	1	1	1	1	ON
Dual Channel Complementary	0	0	0	1	OFF
	0	1	0	1	OFF
	1	0	1	0	ON
	1	1	0	1	OFF

Dual Channels, Equivalent

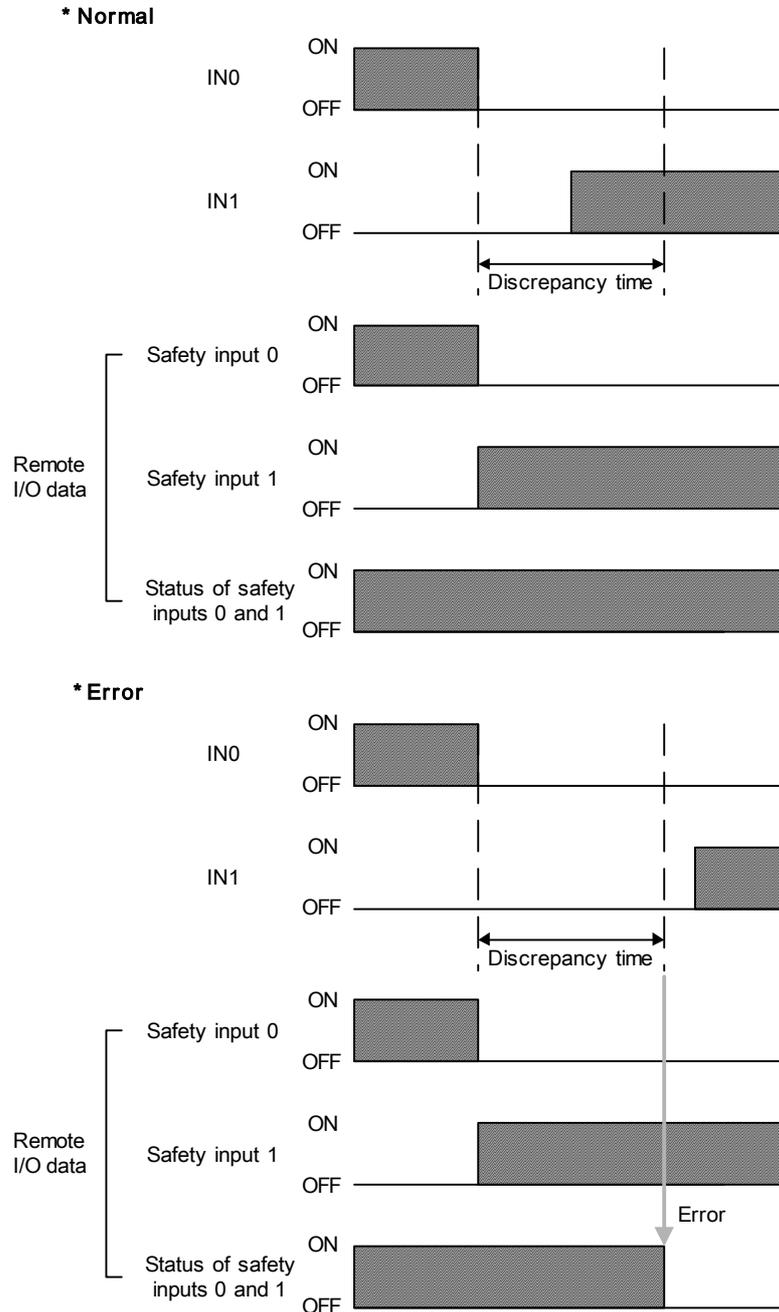
The status is treated as normal when both channels are ON or OFF. If one channel is ON and the other channel is OFF, it will be treated as an error, and the safety input data and the individual safety input status will turn OFF for both inputs.



1-4 Description of Safety Functions

Dual Channels, Complementary

The status is treated as normal when one channel is ON and the other channel is OFF. When both channels are ON or both channels are OFF, it is treated as an error, and the safety input data and the individual safety input status will turn OFF for both inputs.



Error Recovery

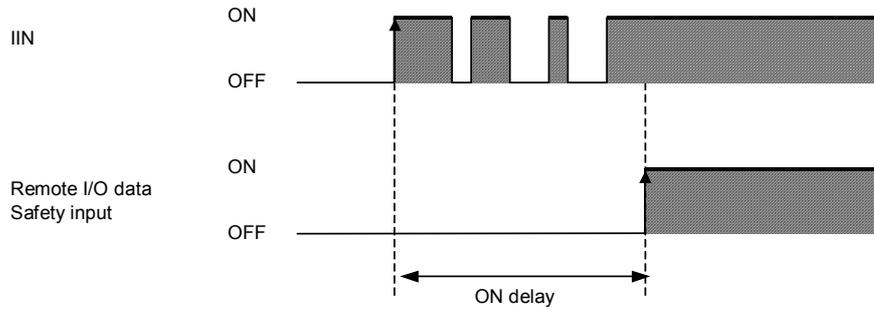
All conditions below are necessary to recover from an error that has occurred in a safety input.

- The cause of the error must be removed.
- The error latch time must have passed.
- The input signal must return to an inactive state and there must be no error condition detected. (e.g., by pressing the emergency stop button or opening a door)

Input Delays

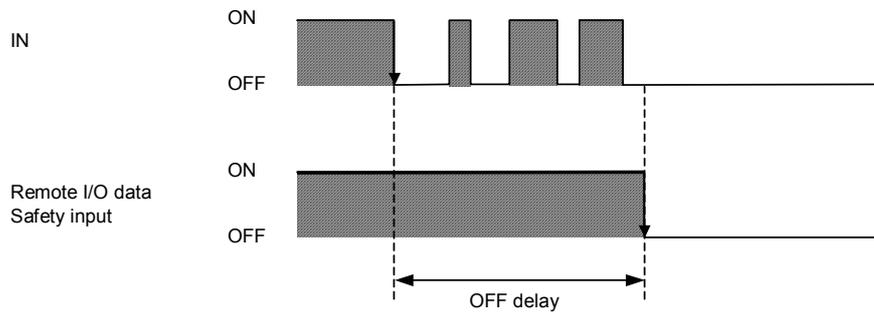
ON Delay

An input signal is treated as being OFF during the ON delay setting time (0 to 126 ms, in increments of 6 ms) after the input contact's rising edge. The input will turn ON only if the input contact remains ON after the ON delay time has elapsed. This helps prevent chattering of the input contacts.



OFF Delay

An input signal is treated as being ON during the OFF delay setting time (0 to 126 ms, in increments of 6 ms) after the input contact's falling edge. The input will turn OFF only if the input contact remains OFF after the OFF delay time has elapsed. This helps prevent chattering of the input contacts.

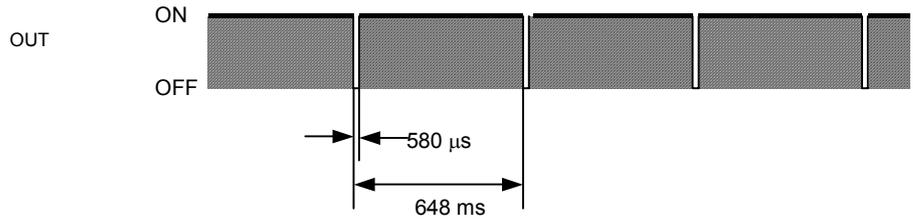


1-4-3 Safety Outputs

Safety Output with Test Pulse

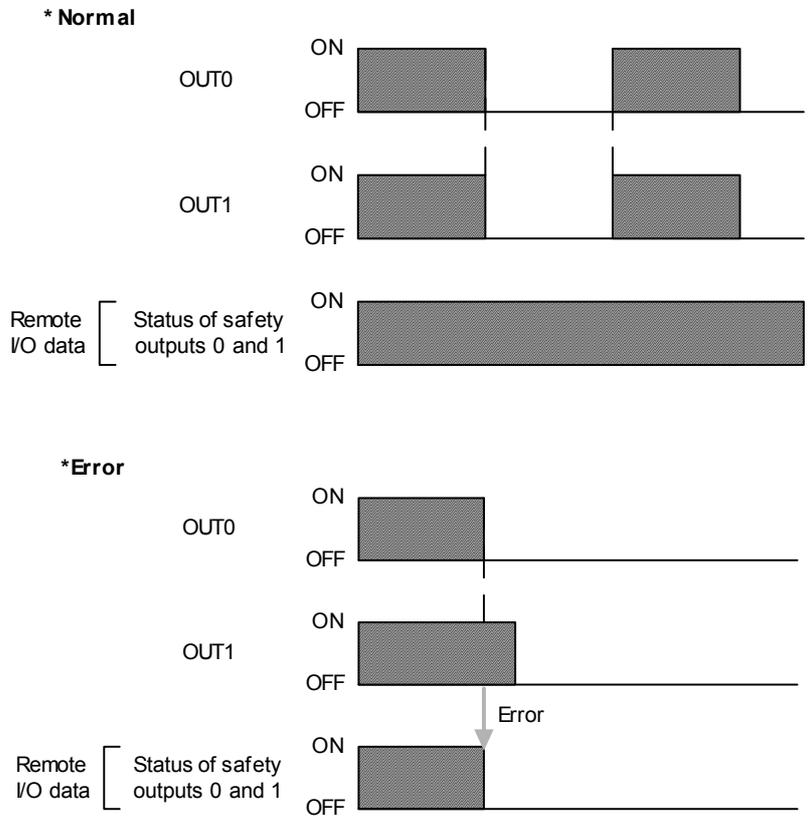
When the output is ON, the test pulse is turned OFF for 470 μ s in a cycle of 648 ms. Using this function, short-circuits between output signal lines and the power supply (positive side) and short-circuits between output signal lines can be detected. If an error is detected, the safety output data and the individual safety output status will turn OFF.

IMPORTANT To prevent the test pulse from causing the connected device to malfunction, pay careful attention to the input response time of the device.



Dual Channel Setting

When both channels are normal, the outputs can be turned ON. The status is treated as normal when both channels are normal. If an error is detected for one channel, the safety output data and the individual safety output status will turn OFF for both channels.



Error Recovery

All conditions below are necessary to recover from an error that has occurred in a safety output.

- The cause of the error must be removed.
- Error latch time must have passed.
- The output signals to the output I/O tags from the user application that correspond to the safety output must go inactive.

1-4-4 Input Reaction Time

The input delay is the time from when an input signal is changed to when the new signal status is sent to the network.

Max. Input Reaction Time: 16.2ms + setting value of ON/OFF delay

Note: Refer to the *System Configuration Manual (Z905)* for system reaction time.

1-4-5 Output Reaction Time

The output delay is the time from when a network signal is received to when the status of the output terminal is changed.

Max. Output Reaction Time: 6.2ms + 20ms (Relay response time, DST1-MRD08SL-1 only)

Note: Refer to the *System Configuration Manual (Z905)* for system reaction time

1-4-6 I/O Status Data

In addition to I/O data, the DST1-series Safety I/O Terminals support status data to check the I/O circuits. The status data includes the following data, for which remote I/O communications can be performed.

- Normal Flags (ON when there is no faults in the internal circuit and the external wiring)
- An AND Flag of the Normal Flags
- Output monitors (the actual output ON/OFF status)

Normal Flags

Normal Flags indicates whether each safety input, safety output, or test output is normal (normal status: ON, error status: OFF).

Output Monitors

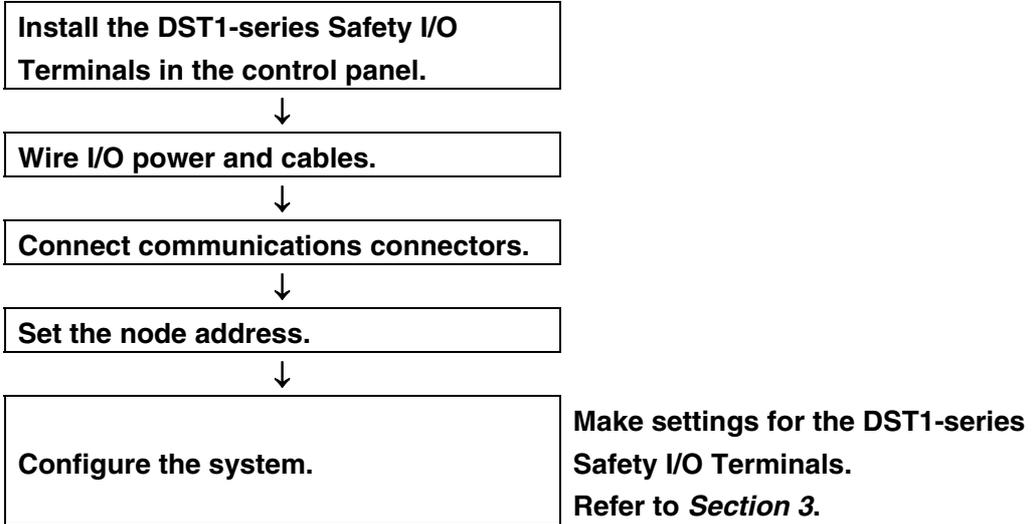
The outputs monitors indicated the actual ON/OFF status of the safety outputs.

Section 2

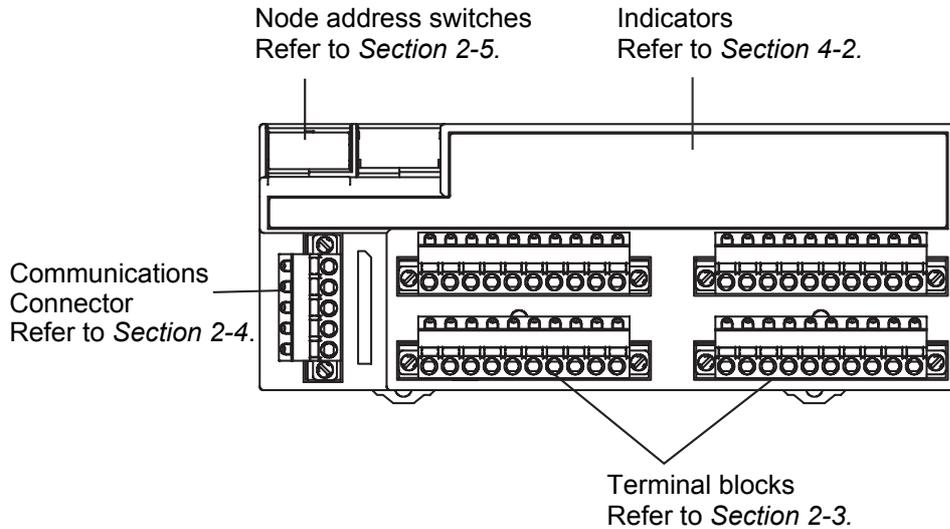
General Procedure

2-1 General Procedure

The general procedure for using the DST1-series Safety I/O Terminals is given below. Refer to the *DeviceNet Operation Manual* (Cat.No.W267) for the network structure and the topology.

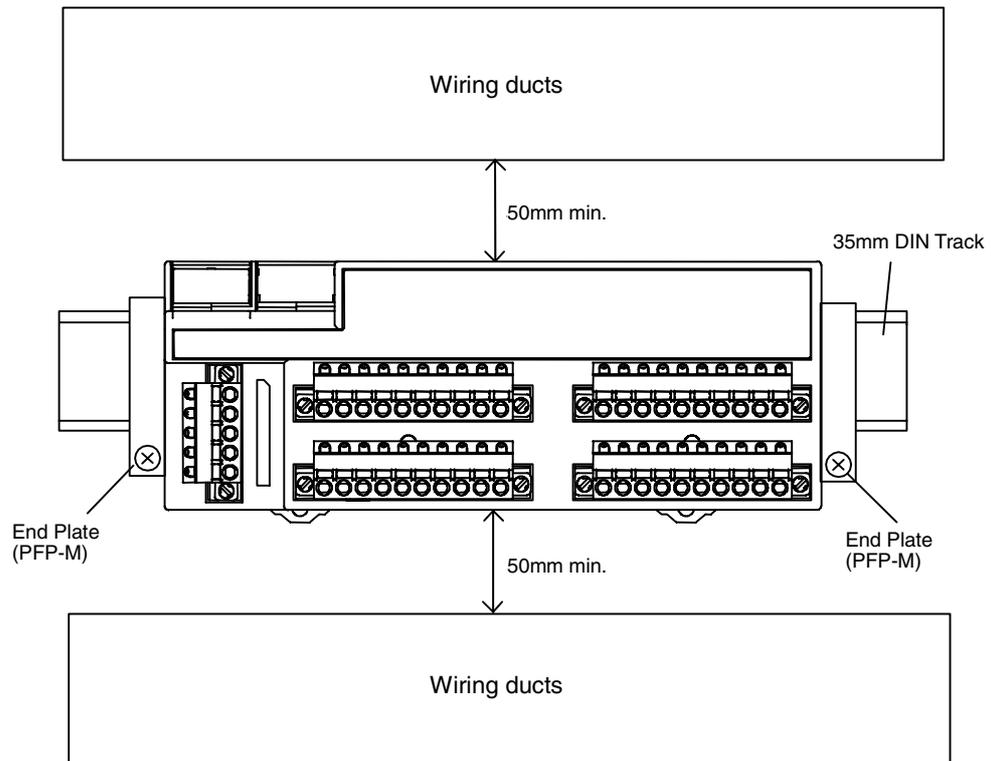


The baud rate of the entire system is determined by the baud rate of the Master Unit. The baud rate does not need to be set for each DST1-series Safety I/O Terminals.



2-2 Installation

Use the DIN Track (35 mm wide) to install the DST1-series Safety I/O Terminals in the control panel.



* Refer to the descriptions of individual DST1 models (*Section 5*) for dimensions.

IMPORTANT

- Use the DST1 in an environment that is within the general specifications.
- Use the DST1 in an enclosure rated IP54 (IEC 60529) or higher.
- Use DIN Track (35 mm wide) to mount the DST1 in the control panel.
- Always use an End Plate on each end of the DST1 to secure it.
- Allow a minimum of 50 mm above and below the DST1 for ventilation.

2-3 Connecting I/O Power and I/O Cable

The following table shows the applicable wires for the I/O connector (when using recommended post crimp terminals).

Solid wire	0.2 to 2.5 mm ² (AWG 24 to AWG 12)
Stranded wires	0.34 to 1.5 mm ² (AWG 22 to AWG 16)

* Refer to the descriptions of individual DST1 models (*Section 5*) for the terminal arrangement of the terminal block and wiring for external I/O.

Recommended Materials and Tools

Ferrules with Plastic Insulating Collars

Use the ferrules with insulating collars conforming to DIN 46228-4. Ferrules with similar appearance but not conforming to the standard may not match the terminal blocks of the DST1-series Safety I/O Terminals. (The wire dimensions shown below are rough dimensions. Confirm before application.)

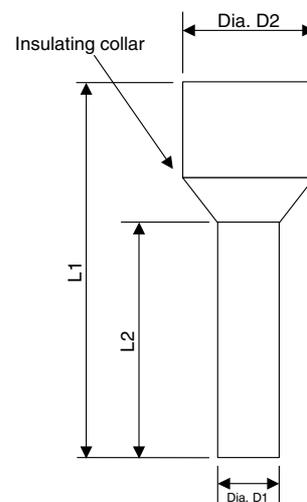
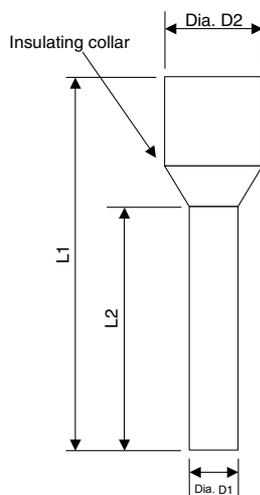
Note: Use wires of the same diameter for any two-wire ferrules that are used.

Reference Specifications (Product Specifications from Phoenix Contact)

Model of ferrule	Wire dimensions		Ferrule specifications					Dimensions
	Cross-sectional area of conductor (mm ²)	AWG	Removed length of insulation (mm)	Overall length L1 (mm)	Length of metal part L2 (mm)	Inner diameter of conductor D1 (mm)	Inner diameter of insulation cover D2 (mm)	
For one wire	AI 0,34-8TQ	0.34	22	10	12.5	8	0.8	*1
	AI 0,5-10WH	0.5	20	10	16	10	1.1	
	AI 0,75-10GY	0.75	18	10	16	10	1.3	
	AI 1-10RD	1.0	18	10	16	10	1.5	
	AI 1,5-10BK	1.5	16	10	18	10	1.8	
For two wires	AI-TWIN 2 x 0,75-10GY	2 x 0.75	-	10	17	10	1.8	*2
	AI-TWIN 2 x 1-10RD	2 x 1	-	10	17	10	2.05	

* 1 For One Wire

* 2 For Two Wires



Crimping Tool for Ferrules

Manufacturer	Model
Phoenix Contact	CRIMPFOX UD6

IMPORTANT

- Use ferrules when wiring cables.
- I/O connectors are detachable. Tighten the screws on the I/O connector to 0.25 to 0.3 N·m.
- The I/O connector has a structure that helps prevent incorrect wiring. Make connections at the specified locations corresponding to the terminal numbers.
- Do not remove the label from the DST1 before wiring.
- Always remove the label after completing wiring to ensure proper heat dispersion.

2-4 Connecting the Communications Connector

Colored stickers are provided on the communications connector that match the colors of the lines to be inserted. Check that the colors of the lines and stickers match when wiring the connectors. The colors are as follows:

Color	Signal
Red	Power cable positive side (V+)
White	High side of communications data (CAN_H)
-	Shield
Blue	Low side of communications data (CAN_L)
Black	Power cable negative side (V-)

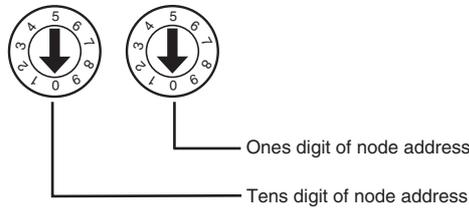
Refer to the *DeviceNet Operation Manual* (Cat.No.W267) for details on communications specifications and wiring.

- IMPORTANT**
- When connecting the communications connector to the DST1, tighten the screws on the communications connector to 0.25 to 0.3 N·m.
 - OMRON's S8□□ Power Supplies are recommended for communications power.

- Note**
- The internal power for the DST1-series Safety I/O Terminals is supplied from the communications power supply (V+, V-).

2-5 Node Address

Set the node address using the two rotary switches on the front panel of the DST1-series Safety I/O Terminals. The default setting is 63. Set the tens digit of the node address (decimal) using the left rotary switch and set the ones digit using the right rotary switch. A value between 00 and 63 can be set.



If a node address between 64 and 99 is set, the node address can be set from the Network Configurator.

- IMPORTANT**
- *The node address must be set while the communications power supply is turned OFF.*
 - *Do not change the rotary switches while the power is ON. The DST1-series Safety I/O Terminals will detect this as a change in the configuration and will switch to fault state.*
 - *Use a small flat-blade screwdriver to set the rotary switches, being careful not to scratch them.*

2-6 Configuration

Configure the DST1-series Safety I/O Terminals using the Network Configurator. Refer to *Section 3 Configuration* for details on settings. Refer to the *System Configuration Manual* (Cat.No.Z905) for Network Configurator operating procedures.

Section 3 Configuration

3-1 Set I/O Parameters

The DST1-series Safety I/O Terminals have five parameter groups: General Parameters, Safety Input Parameters, Test Output Parameters, Safety Output Parameters, and Operating Time Parameters.

The settings in each parameter group are listed in the following tables. All parameters are set using the Network Configurator.

Note: Parameters directly related to safety are marked with (s) in the left column.

3-1-1 General Parameters

	Parameter name	Value	Description	Default
S	Safety Output Error Latch Time	0 to 65,530 ms (in increments of 10 ms)	This parameter is common to all the safety outputs. It sets the time to latch the error state when an error occurs in these outputs. Even when the cause of the error has been removed, the error state will remain latched for the time set here.	1,000 ms
S	Safety Input Error Latch Time	0 to 65,530 ms (in increments of 10 ms)	This parameter is common to all safety inputs and test outputs. It sets the time to latch the error state when an error occurs in these inputs/outputs. Even when the cause of the error has been removed, the error state will remain latched for the time set here.	1,000 ms
	Test Output Idle State	Clear OFF	This parameter is common to all test outputs for which the Test Output Channel Mode is set to <i>Standard Output</i> . It sets the output state of the test output when idle data is received.	Clear OFF
		Keep output data		
	Unit Name	32 characters max.	This parameter sets a user-chosen name for the DST1-series Safety I/O Terminals. The set name is saved in the DST1-series Safety I/O Terminals and displayed in the network configuration.	None
	Threshold Network Power Voltage	8.0 to 30.0 V	This parameter sets the threshold of the network power voltage. When the voltage falls below the set threshold voltage, the corresponding bit in general status turns ON.	11 V
	Threshold Run Hours	0 to 429,496,729 hours	This parameter sets the threshold for unit operating hours. When the operating hours exceeds the set threshold, the corresponding bit in general status will turn ON.	0 hours
	Last Maintenance date	1972/01/01 to 2038/01/19	This parameter saves the maintenance date in the DST1-series Safety I/O Terminals.	1972/01/01

3-1-2 Safety Input Parameters

	Parameter name	Value	Description	Default
S	Off On Delay	0 to 126 ms (in increments of 6 ms)	Sets the OFF/ON delay time.	0 ms
S	Off On Delay	0 to 126 ms (in increments of 6 ms)	Sets the ON/OFF delay time.	0 ms
S	Safety Input Channel Mode	Not Used	The safety input is not used. (External input device not connected.)	Not Used
		Test Pulse from Test Output	Specifies connecting a device with a contact output in combination with a test output. When this mode is selected, select the test output to use for the test source and then set the test output mode to <i>Pulse Test Output</i> . When these settings are made, contact between the input signal line and the power supply (plus) and short circuits with other input signal lines can be detected.	
		Used as Safety Input	Specifies connecting a safety device with a semiconductor output, such as a light curtain.	
		Used as Standard Input	Specifies connecting a standard device (i.e., a non-safety device).	
S	Safety Input Test Source	Not used	If the channel mode of a safety input is set to <i>Test Pulse from Test Out</i> , the test output is selected for use in combination with the safety input. Set the channel mode of the test output selected here to <i>Pulse Test Output</i> .	Not Used
		Test Output 0		
		Test Output 1		
		Test Output 2		
		Test Output 3		
S	Dual Channel Safety Input Mode	Single Channel	Specifies using Single Channel Mode. If <i>Single Channel</i> is selected, the safety input that would be paired for the dual channel parameter will also be set to Single Channel Mode.	Dual Channel Equivalent
		Dual Channel Equivalent	Specifies using the Dual Channel Equivalent Mode with a paired safety input.	
		Dual Channel Complementary	Specifies using Dual Channel Complementary Mode with a paired safety input.	
S	Dual Channel Safety Input Discrepancy Time	0 to 65,530 ms (in increments of 10 ms)	Sets the time to monitor the logic discrepancy in the dual channel input logic.	0ms
	I/O Comment	32 characters max.	Sets an I/O comment for the safety input. The I/O comment set here is used as the I/O tag in the Logic Editor.	None
	Maintenance Counter Mode Choice	Time	Sets the operating mode for the maintenance counter.	Time
		Count		
	Threshold Maintenance Counter	0 to 4,294,967,295 hours	Sets the threshold value for the maintenance counter	0

IMPORTANT When the Safety Input Channel Mode is set to *Test Pulse from Test Out*, specify the test output to use for the test source and set the Test Output Channel Mode of the test output to *Pulse Test Output*.

3-1 Set I/O Parameters

3-1-3 Test Output Parameters

	Parameter name	Value	Description	Default
S	Test Output Mode	Not Used	The corresponding test output is not used.	Not Used
		Standard Output	Specifies connecting to the input for a muting lamp or PLC. Used as a monitor output.	
		Pulse Test Output	Specifies connecting a device with a contact output in combination with the safety input.	
		Power Supply Output	Specifies connecting to the power supply terminal of a safety sensor. The voltage supplied from the test output to the I/O power supply (V, G) is output.	
		Muting Lamp Output (Terminal T3 only)	Specifies a muting lamp output. When the output is ON, disconnection of the muting lamp can be detected.	
	Fault Action	Clear OFF	Sets the output state of the test output when a communications error occurs. This parameter is enabled when the Test Output Channel Mode is set to <i>Standard Output</i> or <i>Muting Lamp Output</i> .	Clear OFF
		Hold Last Data		
	I/O Comment	32 characters max.	Sets an I/O comment for the test output. The I/O comment set here is used as the I/O tag in the Logic Editor.	None
	Maintenance Counter Mode Choice	Time	Sets the operating mode for the maintenance counter.	Time
		Count		
	Threshold Maintenance Counter	0 to 4,294,967,295 hours	Sets the threshold value for the maintenance counter.	0

3-1-4 Safety Output Parameters

	Parameter name	Value	Description	Default
S	Safety Output Channel Mode	Not Used	The safety output is not used. (External output device not connected.)	Not Used
		Safety	Specifies not outputting the test pulse when the output is ON. Contact between the output signal line and the power supply (positive) when the output is OFF and ground faults can be detected.	
		Safety Pulse Test (Can be set the DST1-MD16SL-1 only.)	Outputs the test pulse when the output is ON. Contact between the output signal line and the power supply, and short circuits with other output signal lines can be detected.	
S	Dual Channel Safety Output Mode	Single Channel	Specifies using Single Channel Mode. When <i>Single Channel</i> is set, the safety output that would be paired for the dual channel parameter is also set to Single Channel Mode.	Dual Channel
		Dual Channel	Specifies using Dual Channel Mode. When both of the safety outputs to be paired are normal, the outputs can be turned ON.	
	I/O Comment	32 characters max.	Sets an I/O comment for the safety output. The I/O comment set here is used as the I/O tag in the Logic Editor.	None
	Maintenance Counter Mode Choice	Time	Sets the operating mode for the maintenance counter.	Time
		Count		
	Threshold Maintenance Counter	0 to 4,294,967,295 hours	Sets the threshold value for the maintenance counter.	0

3-1-5 Operation Time Parameters

	Parameter name	Value	Description	Default
	Equipment Name	32 characters max.	Sets a comment for the operation time to monitor.	None
	Threshold Response Time	0 to 65,535 ms (in increments of 1 ms)	Sets the threshold value for the operation time.	0 ms

3-2 Remote I/O Allocations

3-2-1 I/O Allocations

The DST1-series Safety I/O Terminals internally store I/O data. Connection paths can be set using the Network Configurator to allocate I/O data for the Master Unit. Be sure to set the required connection paths.

3-2-2 I/O Data

The DST1-series Safety I/O Terminals store the following data.

- **SAFE:** The Controller can use this information in safety-related functions.
- **NON-SAFE:** Additional information that must not be relied on for safety functions.

Data		Description
Input data	Safety Input Data SAFE	Indicates the ON/OFF status of each input terminal. • ON: 1 • OFF: 0
	Combined Safety Input Status SAFE	An AND of the status of all input terminals. • All terminals are normal: 1 • An error has been detected in one or more input terminals: 0
	Individual Safety Input Status SAFE	Indicates the status of each input terminal. • Normal: 1 • Error: 0
	Combined Safety Output Status SAFE	An AND of the status of all output terminals. • All terminals are normal: 1 • An error has been detected in one or more output terminals: 0
	Individual Safety Output Status SAFE	Indicates the status of each output terminal. • Normal: 1 • Error: 0
	Muting Lamp Status SAFE	Indicates the status when terminal T3 is configured as the muting lamp output. • Normal: 1 • Error: 0
	Safety Output Monitor NON-SAFE	Monitors the outputs of the safety output terminals. • ON: 1 • OFF: 0
	Individual Test Output Status NON-SAFE	Indicates the status of each of the test output terminals. • Normal: 1 • Error: 0
	General Status Data NON-SAFE	Bit 0
Bit 1		Safety Output Power Status Flag 0: Output power supply ON 1: Output power supply OFF
Bit 2		Network Power Voltage Drop Flag 0: Normal (higher than set monitor value) 1: Error (same as or lower than set monitor value)
Bit 3		Unit Maintenance Flag 0: Within range (lower than set monitor value) 1: Over range (same as or higher than set monitor value)
Bit 4		Reserved
Bit 5		Combined I/O Port Status Flag 0: Normal (all I/O points normal) 1: Error (one or more I/O point error)

Data		Description	
		Bit 6	Operation Time Exceeded Flag 0: Within range (all I/O values are lower than set monitor value) 1: Over range (one or more value is same as or higher than set value)
		Bit 7	Connected Component Maintenance Flag 0: Within range (all I/O points are lower than set monitor value) 1: Over range (one or more I/O point is same as or higher than set monitor value)
Output data	Safety Output Data SAFE	Controls the safety output. • ON: 1 • OFF: 0	
	Standard Output Data NON-SAFE	Controls the test output when test output mode is set to a standard output. • ON: 1 • OFF: 0	

3-2-3 I/O Data Supported by Each Model

The following tables show the I/O data supported by each model of the DST1-series Safety I/O Terminals.

Refer to 3-2-4 I/O Assembly Data for data arrangements.

From among the I/O data, safety connections for up to four items, including one output, can be allocated for the Master Unit and standard connections for up to two items can be allocated for the Master Unit.

IMPORTANT Communications with up to 15 Safety Controllers for each connection can be performed using multi-cast connection. If four connections are used, however, only a maximum of 30 Safety Controllers total can communicate with the DST1-series Safety I/O Terminals.

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The default I/O data is as follows:

Safety connection: Safety input assembly 1 (instance No. 20C)

Standard connection: The default value depends on the connection that is selected.

Connection	Default (assembly instance number)
Poll	Safety input assembly 6 (No. 312), Standard output (No. 21)
Bit strobe	Safety input assembly 6 (No. 312)
COS	Test output status with general status (No. 340)
Cyclic	Test output status with general status (No. 340)

The following I/O data can be selected from the Network Configurator.

3-2 Remote I/O Allocations

Safety connection	Standard connection	Network Configurator setting	Assembly Instance No.	I/O size (bytes)	Inputs								Outputs			
					Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Monitors	Individual Test Output Status	General Status	Safety Output Data	Standard Output Data	
✓	✓	Safety input assembly 1	20C	Input 2	✓											
✓	✓	Safety input assembly 2	224	Input 2	✓		✓									
✓	✓	Safety input assembly 3	22C	Input 3	✓		✓									
✓	✓	Safety input assembly 4	310	Input 2	✓	✓				✓						
✓	✓	Safety input assembly 5	311	Input 4	✓		✓			✓						
✓	✓	Safety input assembly 6	312	Input 4	✓		✓			✓		✓				
✓	✓	Standard output assembly	21	Output 1												✓
	✓	General status assembly	300	Input 1									✓			
	✓	Test output status with general status assembly	340	Input 2								✓	✓			

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The default I/O data is as follows:

Safety connections: Safety input assembly 1 (instance No. 204) and Safety output assembly 1 (instance No. 234)

Standard connection: The default value depends on the connection that is selected.

Connection	Default (assembly instance number)
Poll	Safety input assembly 5 (No. 323), Standard output (No. 21)
Bit strobe	Safety input assembly 5 (No. 323)
COS	Output monitor/test output status with general status assembly (No. 341)
Cyclic	Output monitor/test output status with general status assembly (No. 341)

The following I/O data can be selected from the Network Configurator.

Safety connection	Standard connection	Network Configurator setting	Assembly Instance No.	I/O size (bytes)	Inputs								Outputs			
					Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Monitors	Individual Test Output Status	General Status	Safety Output Data	Standard Output Data	
✓	✓	Safety input assembly 1	204	Input 1	✓											
✓	✓	Safety input assembly 2	320	Input 2	✓	✓		✓		✓						
✓	✓	Safety input assembly 3	321	Input 4	✓		✓		✓	✓						
✓	✓	Safety input assembly 4	322	Input 5	✓		✓		✓	✓	✓					
✓	✓	Safety input assembly 5	323	Input 5	✓		✓		✓	✓	✓	✓				
✓	✓	Standard output assembly	21	Output 1												✓
✓		Safety output assembly 1	234	Output 1										✓		
✓		Safety output assembly 2	351	Output 2											✓	✓
	✓	General status assembly	300	Input 1									✓			
	✓	Output monitor/test output status with general status assembly	341	Input 3							✓	✓	✓			

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The default I/O data is as follows:

Safety connections: Safety input assembly 1 (instance No. 203) and Safety output assembly 1 (instance No. 233)

Standard connection: The default value depends on the connection that is selected.

Connection	Default (assembly instance number)
Poll	Safety input assembly 5 (No. 333), Standard output (No. 21)
Bit strobe	Safety input assembly 5 (No. 333)
COS	Output monitor/test output status with general status assembly (No. 342)
Cyclic	Output monitor/test output status with general status assembly (No. 342)

The following I/O data can be selected from the Network Configurator.

Safety connection	Standard connection	Network Configurator setting	Assembly Instance No.	I/O size (bytes)	Inputs										Outputs			
					Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Output Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Monitors	Individual Test Output Status	General Status	Safety Output Data	Standard Output Data		
✓	✓	Safety input assembly 1	203	Input 1	✓													
✓	✓	Safety input assembly 2	330	Input 1	✓	✓		✓			✓							
✓	✓	Safety input assembly 3	331	Input 2	✓		✓			✓	✓							
✓	✓	Safety input assembly 4	332	Input 3	✓		✓			✓	✓	✓						
✓	✓	Safety input assembly 5	333	Input 3	✓		✓			✓	✓	✓	✓					
✓	✓	Standard output assembly	21	Output 1														✓
✓		Safety output assembly 1	233	Output 1														✓
✓		Safety output assembly 2	350	Output 1														✓
	✓	General status assembly	300	Input 1											✓			
	✓	Output monitor/test output status with general status assembly	342	Input 2									✓	✓	✓			

3-2 Remote I/O Allocations

3-2-4 I/O Assembly Data

Input Data

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
203	0	Reserved				Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0

Applicable Terminal: DST1-MRD08SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
204	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0

Applicable Terminal: DST1-MD16SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20C	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Reserved				Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8

Applicable Terminal: DST1-ID12SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
224	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status

Applicable Terminal: DST1-ID12SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
22C	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
	2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status

Applicable Terminal: DST1-ID12SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
300	0	General Status							

Applicable Terminal: DST1-ID12SL-1, DST1-MD16SL-1, DST1-MRD08SL-1

3-2 Remote I/O Allocations

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
310	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Muting Lamp Status	Safety In Status	Reserved		Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8

Applicable Terminal: DST1-ID12SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
311	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
	2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status
	3	Muting Lamp Status	Reserved						

Applicable Terminal: DST1-ID12SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
312	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
	2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status
	3	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status

Applicable Terminal: DST1-ID12SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
320	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Muting Lamp Status	Safety In Status	Safety Out Status	Reserved				

Applicable Terminal: DST1-MD16SL-1

3-2 Remote I/O Allocations

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
321	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
	2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
	3	Muting Lamp Status	Reserved						

Applicable Terminal: DST1-MD16SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
322	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
	2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
	3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
	4	Muting Lamp Status	Reserved						

Applicable Terminal: DST1-MD16SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
323	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
	2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
	3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
	4	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status

Applicable Terminal: DST1-MD16SL-1

3-2 Remote I/O Allocations

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
330	0	Muting Lamp Status	Safety In Status	Safety Out Status	Reserved	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0

Applicable Terminal: DST1-MRD08SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
331	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Muting Lamp Status	Reserved			Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status

Applicable Terminal: DST1-MRD08SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
332	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
	2	Muting Lamp Status	Reserved						

Applicable Terminal: DST1-MRD08SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
333	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	1	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
	2	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status

Applicable Terminal: DST1-MRD08SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
340	0	General Status							
	1	Reserved				Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status

Applicable Terminal: DST1-ID12SL-1

3-2 Remote I/O Allocations

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
341	0	General Status							
	1	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
	2	Reserved				Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status

Applicable Terminal: DST1-MD16SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
342	0	General Status							
	1	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor

Applicable Terminal: DST1-MRD08SL-1

Output Data

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
21	0	Reserved				Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0

Applicable Terminal: DST1-ID12SL-1, DST1-MD16SL-1, DST1-MRD08SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
233	0	Reserved				Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0

Applicable Terminal: DST1-MRD08SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
234	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0

Applicable Terminal: DST1-MD16SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
350	0	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0

Applicable Terminal: DST1-MRD08SL-1

Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
351	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
	1	Reserved				Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0

Applicable Terminal: DST1-MD16SL-1

Section 4 Specifications

4-1 Specifications

4-1 Specifications

4-1-1 Common Specifications

Item	Specifications
Communications power supply voltage	11 to 25 V DC (Supplied from the communications connector.)
I/O power supply voltage	20.4 to 26.4 V DC (24 V DC, -15% to +10%)
EMC	Conforms to IEC61131-2.
Vibration resistance	10 to 57 Hz: 0.35 mm 57 to 150 Hz: 50 m/s ²
Shock resistance	150 m/s ² for 11 ms DST1-MRD08SL-1: 100 m/s ² for 11ms
Operating temperature	-10 to 55°C
Relative humidity	10% to 95% (with no condensation) DST1-MRD08SL-1: 10% to 85% (with no condensation)
Operating environment	No corrosive gases
Storage temperature	-40 to 70°C
Mounting	35-mm DIN Track
Degree of protection	IP20
Overvoltage Category	II

4-1-2 Current Consumption and Weights

Model	Communications current consumption	Weight
DST1-ID12SL-1	100 mA at 24 V DC	420 g
DST1-MD16SL-1	110 mA at 24 V DC	420 g
DST1-MRD08SL-1	100 mA at 24 V DC	600 g

4-1-3 DeviceNet Communications Specifications

Item	Specifications			
Communications protocol	Conforms to DeviceNet and DeviceNet Safety.			
Topology	Combination of multi-drop and T-branch connections (for trunk or branch lines)			
Baud rate	125 kbps, 250 kbps, or 500 kbps			
Communications media	Special 5-wire cable (2 signal lines, 2 power lines, 1 shield line)			
Communications distances	Baud rate	Network length	Branch line length	Total branch line length
	500 kbps	100 m max (100 m max)	6 m max.	39 m max.
	250 kbps	250 m max (100 m max)	6 m max.	78 m max.
	125 kbps	500 m max (100 m max)	6 m max.	156 m max.
	Values in parentheses are the lengths when using Thin Cables.			
Communications power supply	11 to 25 V DC			
Maximum number of nodes	64 nodes (including Configurator when used)			

4-2 Indicators

4-2-1 MS/NS Indicators

This section describes the meanings of MS and NS indicators for the DST1-series Safety I/O Terminals.

The MS (Module Status) indicator displays the status of a node on the network.

The NS (Network Status) indicator displays the status of the entire network.

The MS and NS indicators can be green or red and they can be ON, flashing, or OFF. The meanings indicated by the combination of their colors and status are as given in the following table.

Indicator	Color	Status	Meaning
MS	Green		Normal operation status
			Waiting for safety communication from the safety master
	Red		System failure
			Minor failure (Switch settings incorrect, etc.)
	Green/Red		The DST1 is performing initialization process or waiting for configuration.
	–		Power is not supplied
NS	Green		Online connection has been established.
			Online connection has not been established.
	Red		Unable to communicate
			I/O communication error
	–		Not online/Not powered

 : Lit  : Flashing  : Not lit

4-2-2 Configuration Lock Indicator

The LOCK indicator indicates that the configuration data has been locked.

Indicator	Color	Status	Meaning
LOCK	Yellow		Lock has been completed with a valid configuration.
			Lock has not been completed with a valid configuration.
			Configuration has not been performed.

 : Lit  : Flashing  : Not lit

4-2 Indicators

4-2-3 IN PWR/OUT PWR Indicators

The IN PWR and OUT PWR indicators indicate the status of the I/O power supplied to the DST1-series Safety I/O Terminals.

LED Indicators	Color	Status	Meaning
IN PWR	Green		Normal status of input power
			Input power is not supplied.
OUT PWR	Green		Normal status of output power
			Output power is not supplied. Output power exceeds the upper/lower limit of the power range.

 : Lit  : Flashing  : Not lit

4-2-4 I/O Indicators

The I/O indicators show the ON/OFF and error status of I/O.

Note The indicators are not lit while the DST1-series Safety I/O Terminals is being configured.

Name	Color	Status	Meaning
IN0 to INn (See note.)	Yellow		Safety input ON.
			Safety input OFF.
	Red		Error detected in input circuits. Discrepancy error has occurred set for Dual Channel Mode.
			Error detected in the other input circuit set for Dual Channel Mode (no error in this circuit)
OUT0 to OUTn (See note.)	Yellow		Safety output ON.
			Safety output OFF.
	Red		Error detected in output circuits.
			Error detected in the other output circuit set for Dual Channel Mode (no error in this circuit)

 : Lit  : Flashing  : Not lit

Note: "n" indicates the terminal number.

Section 5
DST1-series

5-1 Safety Input Terminal

5-1-1 Safety Input Specifications

The following table gives the safety input specifications for the DST1-ID12SL-1.

Item	Specifications
Input type	Sinking input (PNP)
ON voltage	11 VDC min.
OFF voltage	5 VDC max.
OFF current	1 mA max.
Input current	6 mA

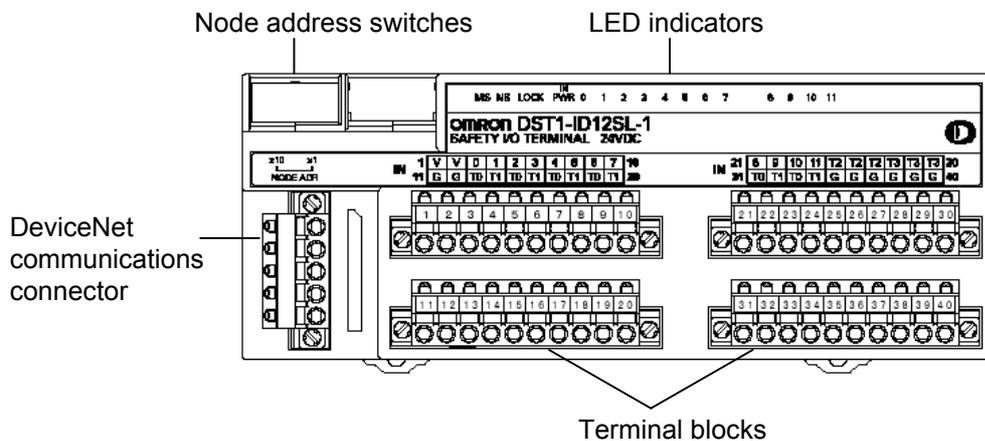
5-1-2 Test Output Specifications

The following table gives the test output specifications for the DST1-ID12SL-1.

Item	Specifications
Output type	Sourcing output (PNP)
Rated output current	0.7 A
Residual voltage	1.2 V max.
Leakage current	0.1 mA max.

5-1-3 Nomenclature

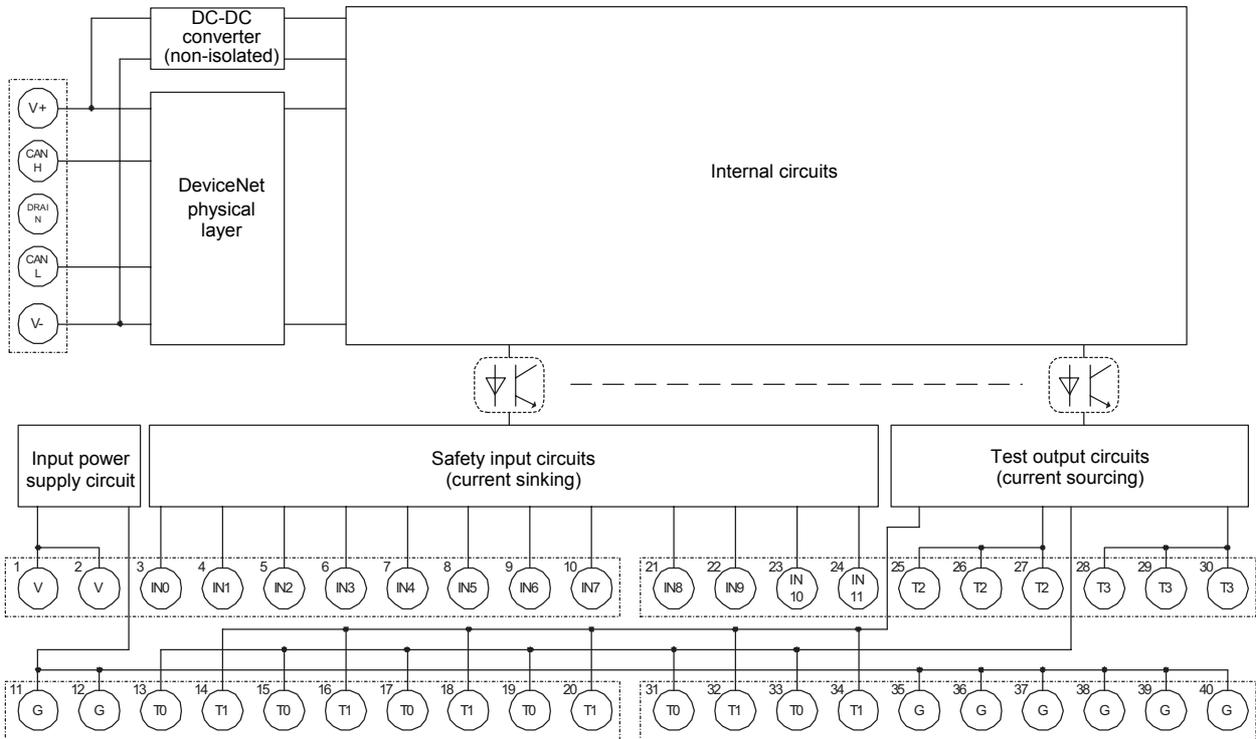
The following figure shows the names of the parts of the DST1-ID12SL-1.



- Refer to *4-2 Indicators* for information on the LED indicators.
- Refer to *2-4 Connecting the Communications Connector* for information on the DeviceNet communications connector.
- Refer to *5-1-4 Internal Circuits and Terminal Arrangement* for information on the terminal blocks.

5-1-4 Internal Circuits and Terminal Arrangement

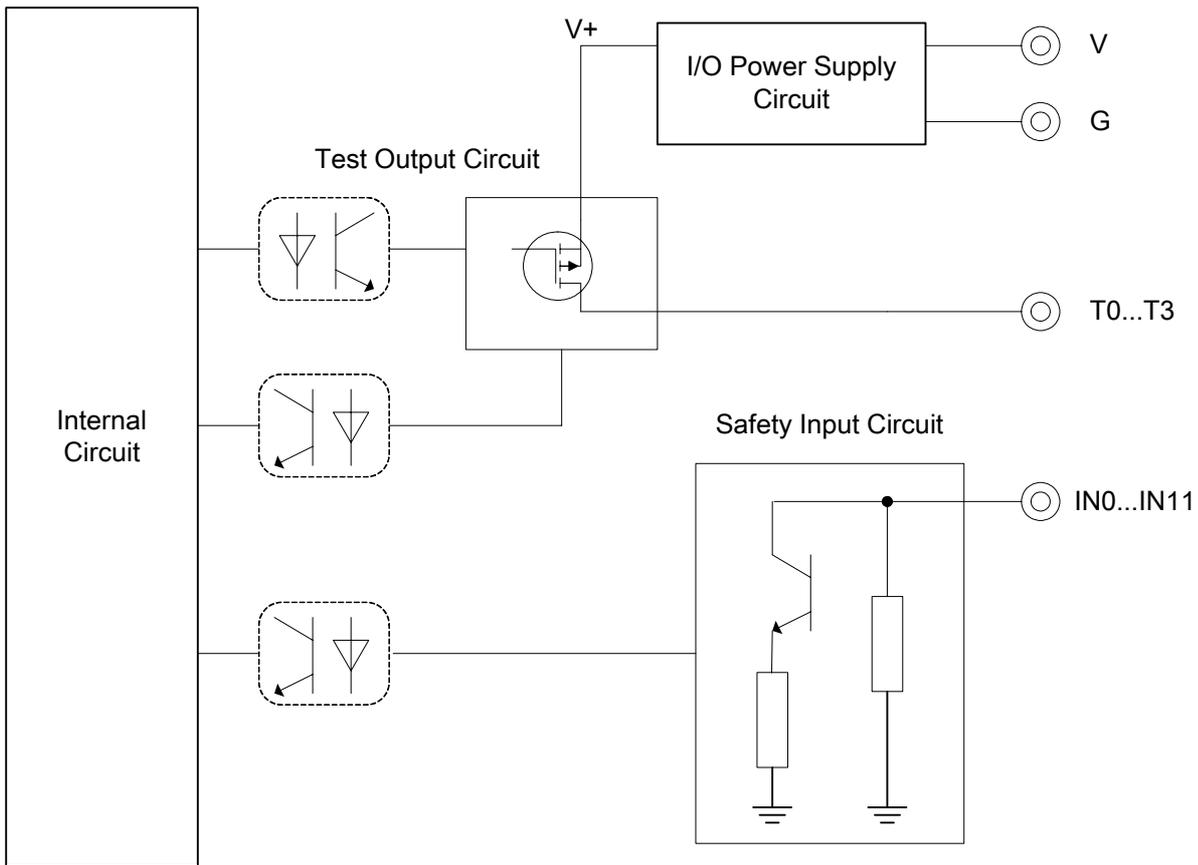
The following figure shows the internal circuits of the DST1-ID12SL-1.



The following table gives the terminal arrangement of the terminal blocks on the DST1-ID12SL-1.

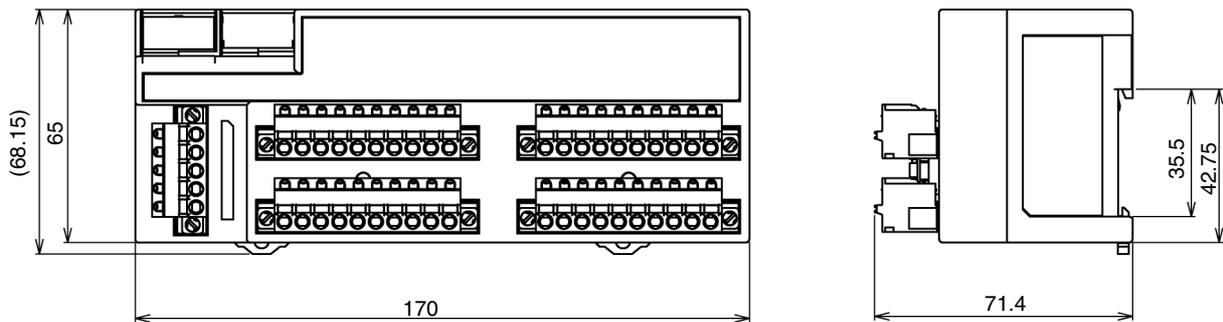
Terminals	Names	Functions
1, 2	V	Power terminals for the input devices and test outputs. (24VDC)
11, 12	G	
35 to 40	G	Common terminals The terminals 11, 12 and 35 to 40 are internally connected.
3 to 10 21 to 24	IN0 to IN11	Terminals for safety inputs
13 to 20 25 to 30 31 to 34	T0 to T3	Terminals for test outputs

5-1 Safety Input Terminal



5-1-5 Dimensions

The following figures show the dimensions of the DST1-ID12SL-1 (unit: mm).



5-2 Safety I/O Terminal with Semiconductor Outputs

5-2-1 Safety Input Specifications

The following table gives the safety input specifications for the DST1-MD16SL-1.

Item	Specifications
Input type	Sinking input (PNP)
ON voltage	11 VDC min.
OFF voltage	5 VDC max.
OFF current	1 mA max.
Input current	6 mA

5-2-2 Test Output Specifications

The following table gives the test output specifications for the DST1-MD16SL-1.

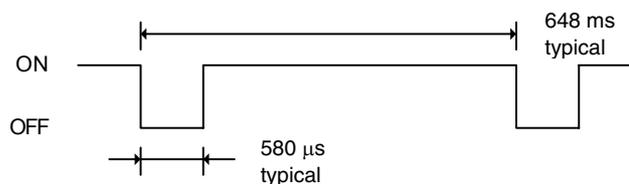
Item	Specifications
Output type	Sourcing output (PNP)
Rated output current	0.7 A
Residual voltage	1.2 V max.
Leakage current	0.1 mA max.

5-2-3 Safety Output Specifications for Semiconductor Outputs

The following table gives the safety output specifications for the Semiconductor outputs on the DST1-MD16SL-1.

Item	Specifications
Output type	Sourcing output (PNP)
Rated output current	0.5 A
Residual voltage	1.2 V max.
Leakage current	0.1 mA max.

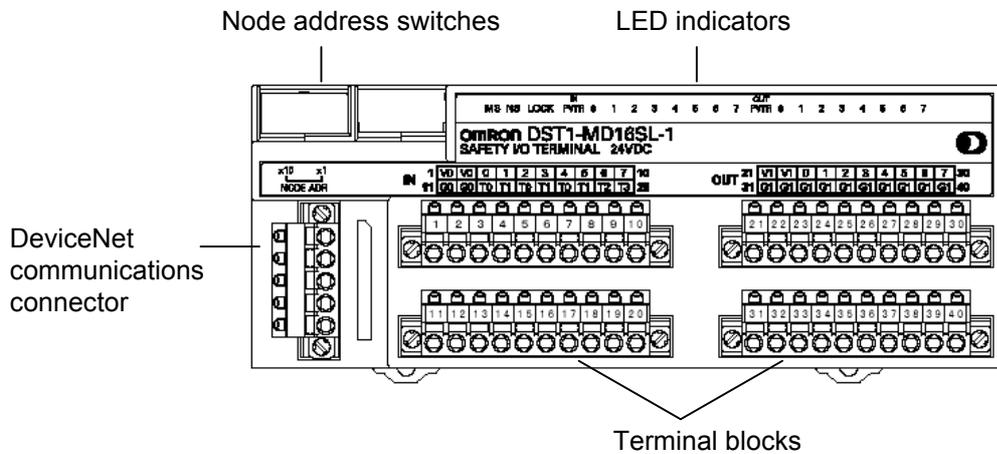
IMPORTANT In case that a safety output is configured as *Safety pulsed test*, while this output is in an ON state, the signal sequence shown below is output continuously to enable diagnosis. Confirm the response times of the devices connected to the safety outputs so that the devices do not malfunction due to the OFF pulse.



5-2 Safety I/O Terminal with Semiconductor Outputs

5-2-4 Nomenclature

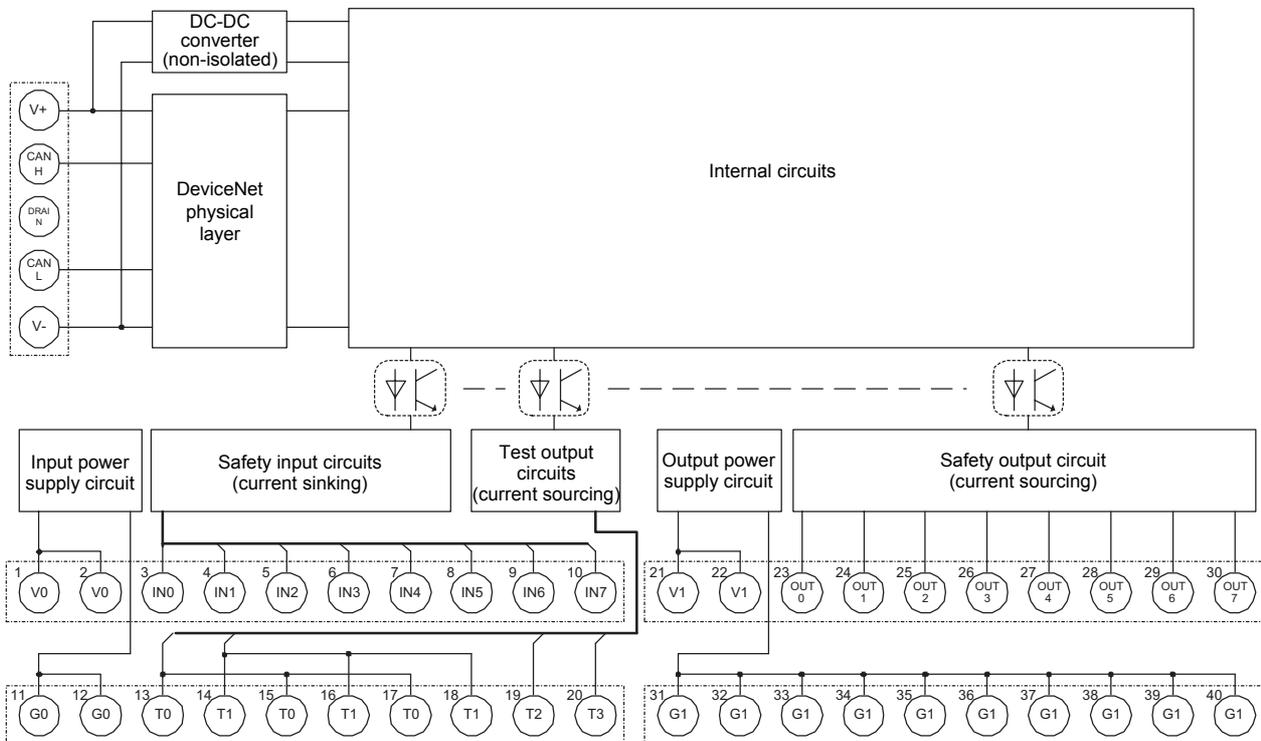
The following figure gives the names of the parts of the DST1-MD16SL-1



- Refer to 4-2 Indicators for information on the LED indicators.
- Refer to 2-4 Connecting the Communications Connector for information on the DeviceNet communications connector.
- Refer to 5-2-5 Internal Circuits and Terminal Arrangement for information on the terminal blocks.

5-2-5 Internal Circuits and Terminal Arrangement

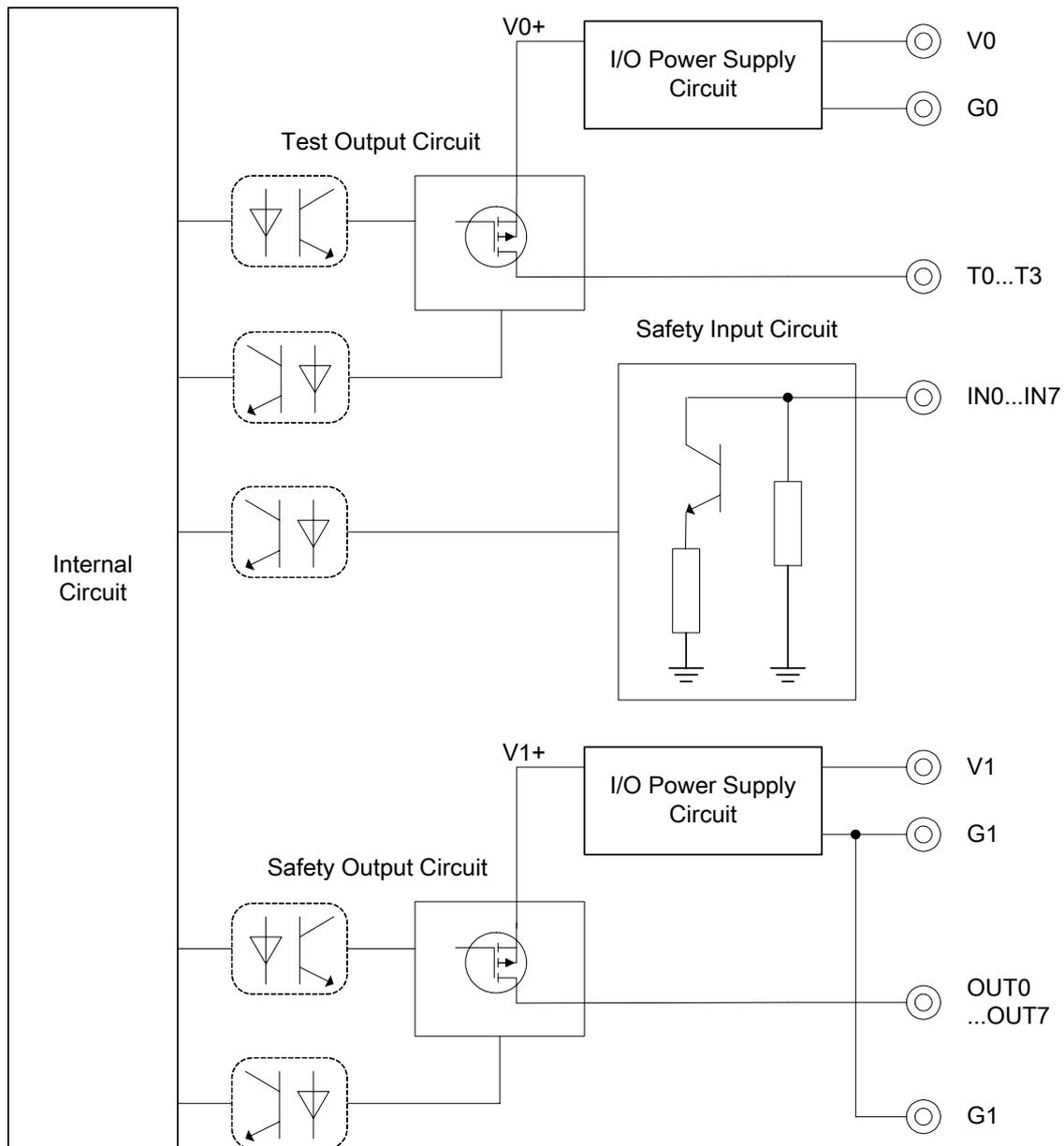
The following figure shows the internal circuits of the DST1-MD16SL-1.



5-2 Safety I/O Terminal with Semiconductor Outputs

The following table shows the terminal arrangement of the terminal blocks on the DST1-MD16SL-1.

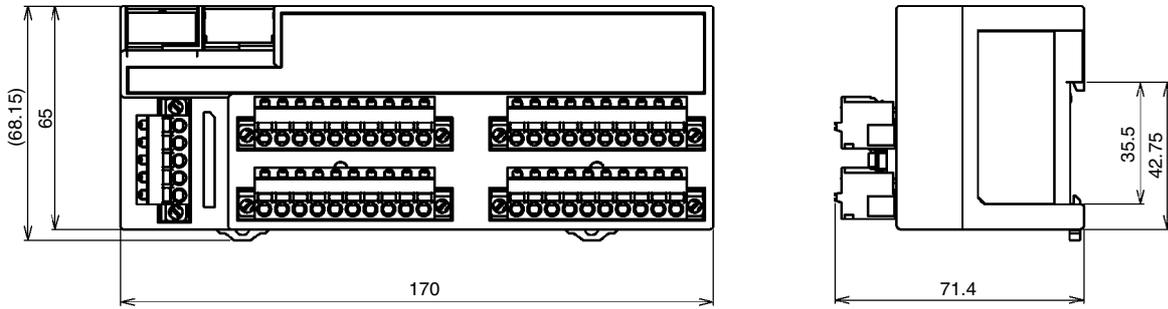
Terminals	Names	Functions
1,2	V0	Power terminals for the input devices and test outputs. (24VDC)
11,12	G0	
3 to 10	IN0 to IN7	Terminals for safety inputs
13 to 20	T0 to T3	Terminals for test outputs
21, 22	V1	Power terminals for the output devices. (24VDC)
31, 32	G1	
23 to 30	OUT0 to OUT7	Terminals for safety outputs
33 to 40	G1	Common terminals. Terminals 31 to 40 are internally connected.



IMPORTANT Power supply terminal V1 for the outputs is internally monitored. Supply the voltage in the specified range (20.4 to 26.4 VDC). If the voltage is supplied outside this range, voltage will not be supplied to the output circuits.

5-2-6 Dimensions

The following figures show the dimensions of the DST1-MD16SL-1 (unit: mm).



5-3 Safety I/O Terminal with Relay Outputs

5-3-1 Safety Input Specifications

The following table gives the safety input specifications for the DST1-MRD08SL-1.

Item	Specifications
Input type	Sinking input (PNP)
ON voltage	11 VDC min.
OFF voltage	5 VDC max.
OFF current	1 mA max.
Input current	6 mA

5-3-2 Test Output Specifications

The following table gives the test output specifications for the DST1-MRD08SL-1.

Item	Specifications
Output type	Sourcing output (PNP)
Rated output current	0.7 A
Residual voltage	1.2 V max.
Leakage current	0.1 mA max.

5-3-3 Safety Output Specifications for Relay Outputs

The following table gives the safety output specifications for the DST1-MRD08SL-1.

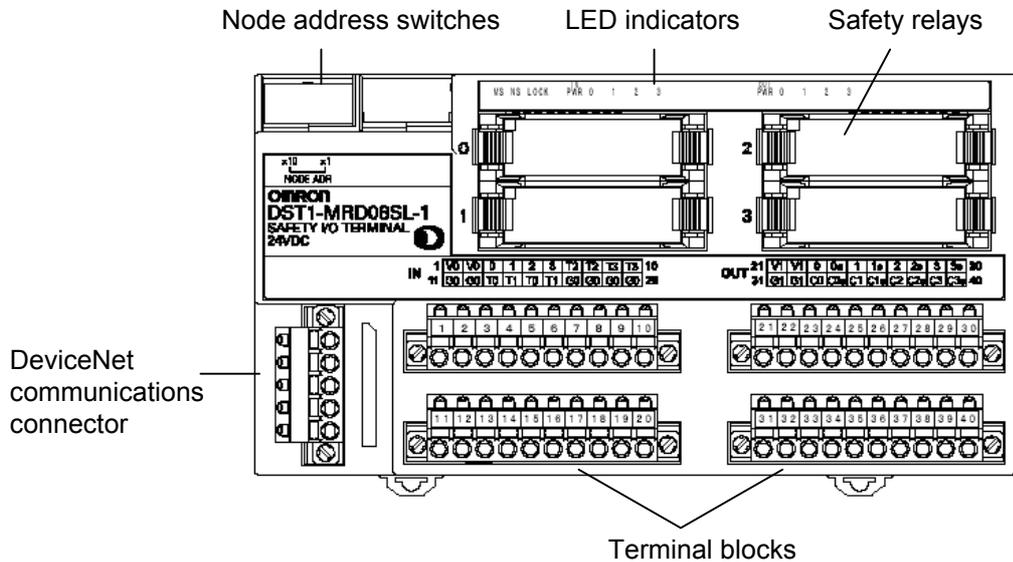
Item	Specifications	
Relays	G7SA-2A2B EN50205 Class A	
Failure rate P level (See note.) (Reference value)	1 mA at 5 VDC	
Rated load for a resistive load	240 VAC: 2 A 30 VDC: 2 A	
Rated load for an inductive load	2 A at 240 VAC ($\cos \phi=0.3$) 1 A at 24 VDC	
Durability	Mechanical life expectancy	5,000,000 operations min. (at approx. 7,200 operations/h)
	Electrical life expectancy	100,000 operations min. (at rated load and approx. 1,800 operations/h)

Note: This value applies to a switching frequency of 300 operations/min.

5-3 Safety I/O Terminal with Relay Outputs

5-3-4 Nomenclature

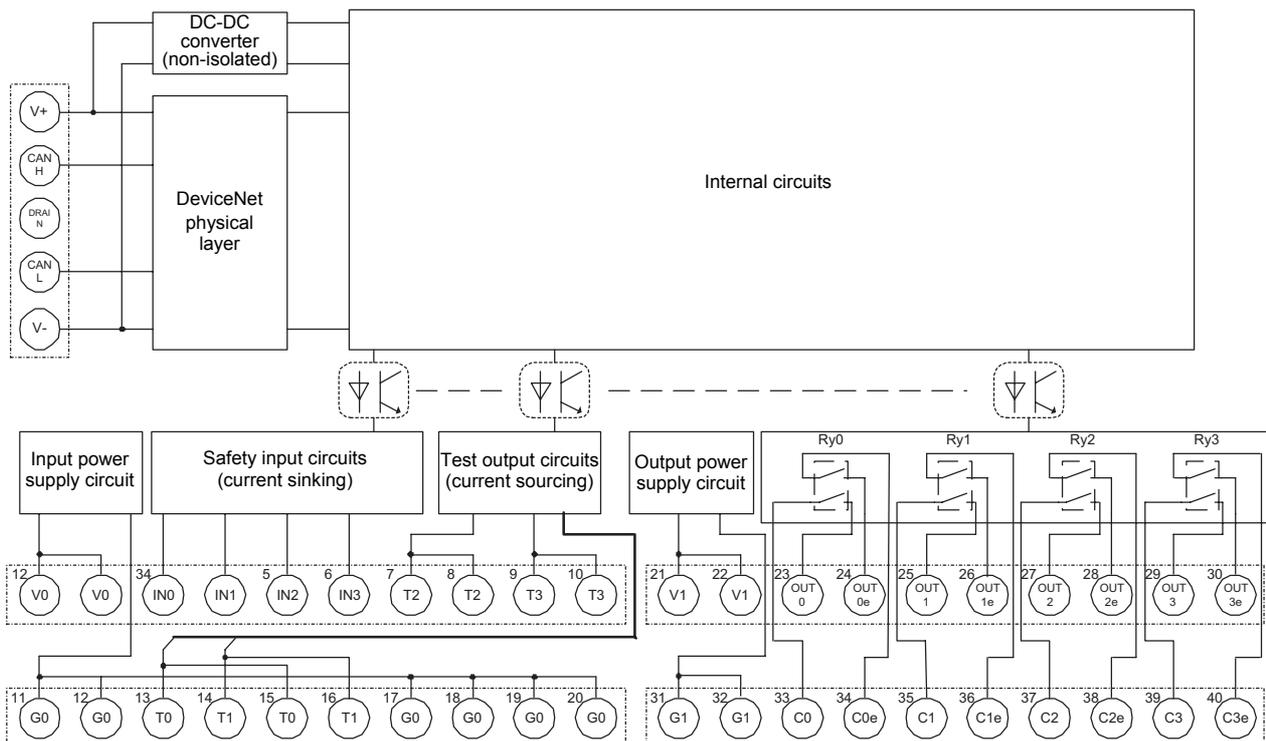
The following figure shows the names of the parts of the DST1-MRD08SL-1.



- Refer to 4-2 *Indicators* for information on the LED indicators.
- Refer to 2-4 *Connecting the Communications Connector* for information on the DeviceNet communications connector.
- Refer to 5-3-5 *Internal Circuits and Terminal Arrangement* for information on the terminal blocks.

5-3-5 Internal Circuits and Terminal Arrangement

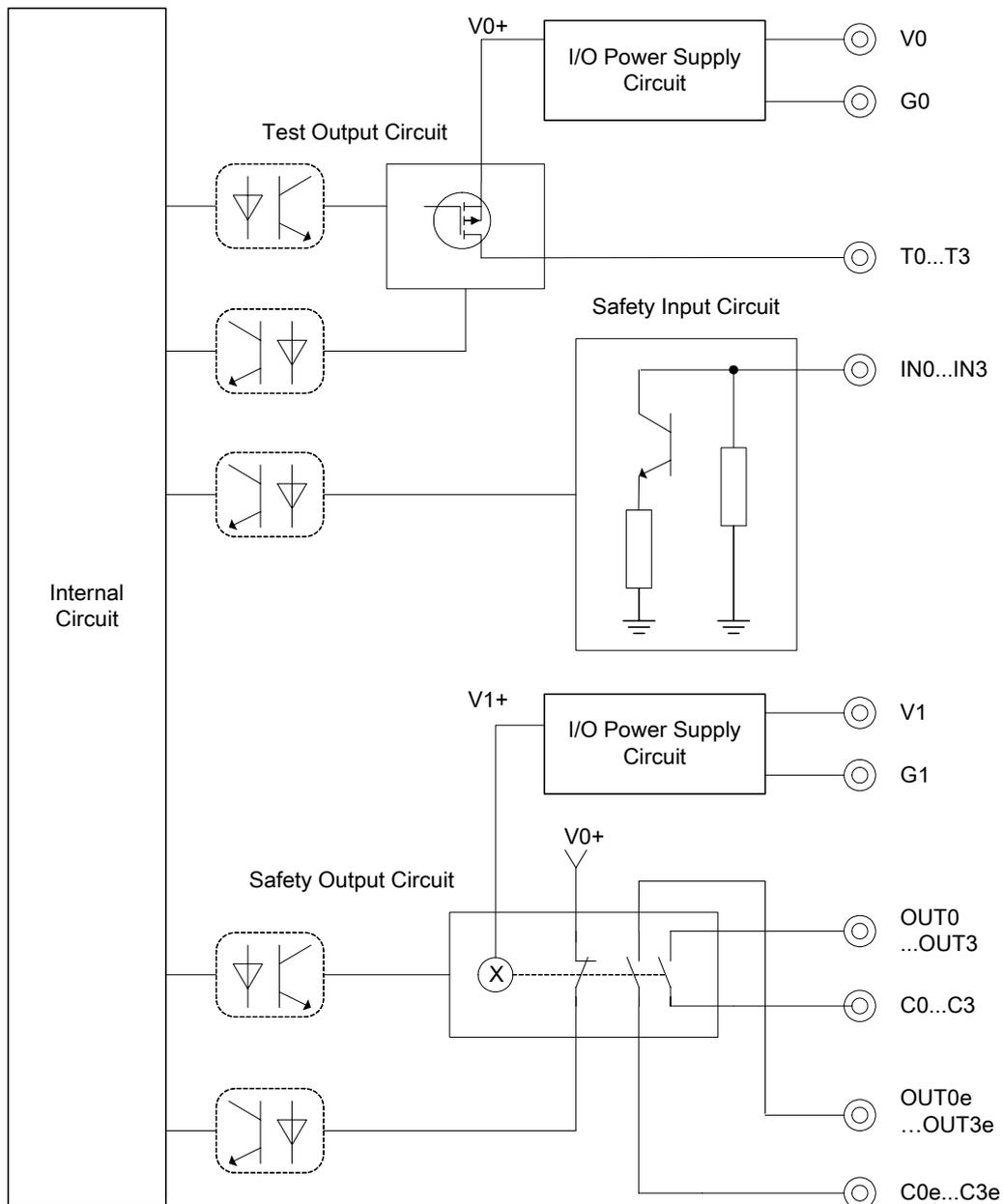
The following figure shows the internal circuits of the DST1-MRD08SL-1.



5-3 Safety I/O Terminal with Relay Outputs

The following table shows the terminal arrangement of the terminal blocks on the DST1-MRD08SL-1.

Terminals	Names	Functions
1, 2	V0	Power terminals for the input devices, test outputs and internal relay feedback monitors.(24VDC)
11, 12	G0	
17 to 20	G0	Common terminals. Terminals 11, 12, and 17 to 20 are internally connected.
3 to 6	IN0 to IN3	Terminals for safety inputs
7 to 10 13 to 16	T0 to T3	Terminals for test/standard outputs
21, 22	V1	Power terminals for driving internal relays.(24VDC)
31, 32	G1	
23 to 30 33 to 40	OUT0 to OUT3 C0 to C3 OUT0e to OUT3e C0e to C3e	Terminals for safety outputs Outputs of terminals 23/33 (OUT0) and 24/34 (OUT0e) are the same. Output of terminals 25/35 (OUT1) and 26/36 (OUT1e) are the same. Output of terminals 27/37 (OUT2) and 28/38 (OUT2e) are the same. Output of terminals 29/39 (OUT3) and 30/40 (OUT3e) are the same.



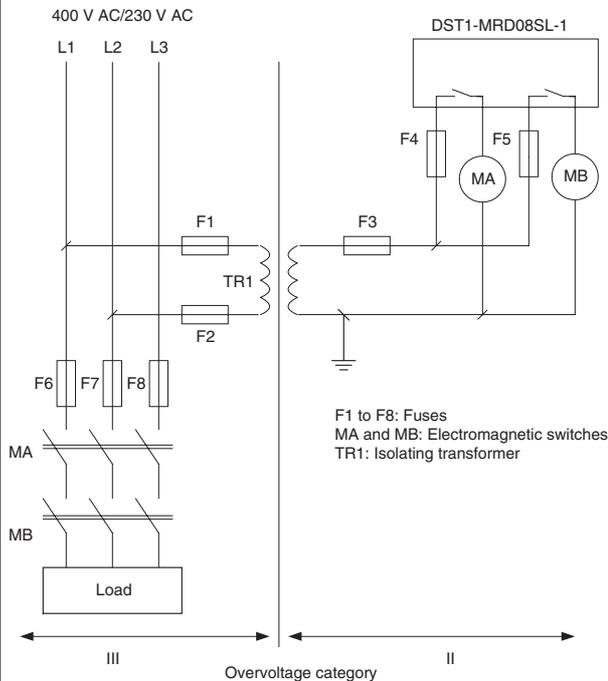


WARNING

For the DST1-MRD08SL-1, isolating transformers, such as TR1, that are used to isolate between overvoltage categories III and II must conform to IEC60742, and the insulation between the primary input and secondary output must satisfy at least the basic insulation standards of overvoltage category III.

One side of the secondary output of the isolating transformer must be grounded to prevent electrical shock in case of short-circuiting to the ground or to the frame of the isolating transformer.

To protect the isolating transformer and to prevent electrical shock in case of short-circuiting to the frame, insert fuses according to transformer specifications, i.e. at points F1, F2, and F3.



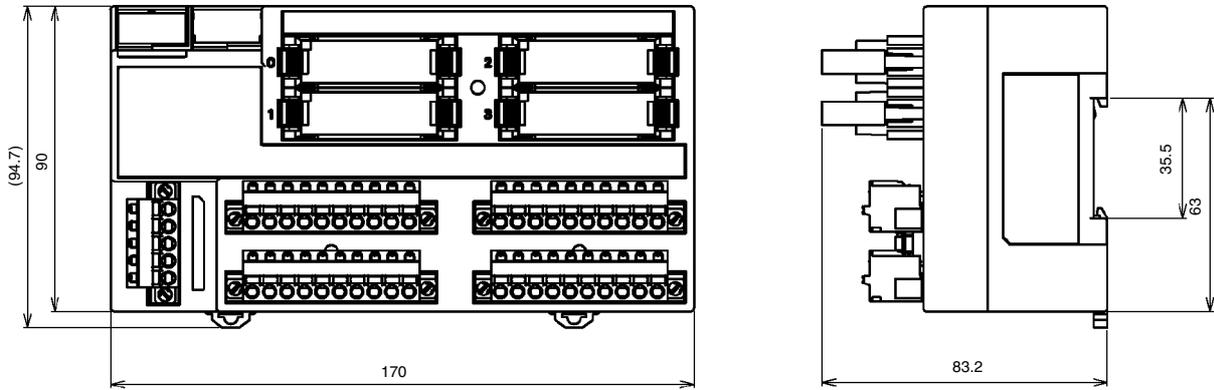
For Model DST1-MRD08SL-1, Insert a fuse rated at 3.15A or less for each output terminal to protect safety output contacts from welding. Confirm the fuse selection with the fuse manufacturer to ensure the dependability of the characteristics of the connected load.



- IMPORTANT**
- Supply power to both V0 and V1. The states of the relay contacts are internally monitored from the power supply of V0.
 - Power supply terminal V1 for the outputs is internally monitored. Supply the voltage in the specified range (20.4 to 26.4 VDC). If the voltage is supplied outside this range, voltage will not be supplied to the output circuits.

5-3-6 Dimensions

The following figures show the dimensions of the DST1-MRD08SL-1 (unit: mm).



Section 6

Troubleshooting and Maintenance

6-1 Indicators and Error Processing

MS		NS		LOCK	I/O PWR	I/O		Description	Probable cause and remedy
Green	Red	Green	Red	Yellow	Green	Yellow	Red		
					-	-	-	Safety I/O communications in progress (normal status)	
					-	-	-	Standard I/O communications or message communications in progress (normal status)	
					-	-	-	The DST1 performing initialization process or waiting for configuration.	
				-	-	-	-	Waiting for safety or standard connection	
				-	-	-	-	Communications timeout	Check the following items and restart the DST1.
				-	-	-	-	BusOff status (communications stopped due to consecutive data errors)	Are lengths of cables (trunk and branch lines) correct? Are cables broken or loose? Are Terminating Resistors connected to both ends of the trunk line only? Is noise interference excessive?
								Node address duplication	Reset the DST1 so that it has a unique node address, and then restart the DST1.
				-	-	-	-	Waiting for completion of node address duplication check at the master	Reset the DST1 so that it has a unique node address, and then restart the DST1.
				-	-	-	-	Switch settings are incorrect	Check the node address, and then restart the DST1.
					-			System failure	Check to see if the positive side of the power supply is in contact with the signal line. Replace the DST1 if the system failure still occurs after turning the power supply ON again.
-	-	-	-	-				Input/output power is not supplied.	Check the following items. Are cables broken? Is the I/O power voltage within specifications?
-	-	-	-	-				An error occurred in an input/ output circuit.	Check the following items. Has a ground fault occurred in the signal line? Is the signal line broken? Are there any troubles with the connected device? Is the power source (positive side) in contact with the signal line? Has a short-circuit occurred in the signal line? - Is the discrepancy time setting suitable? - Is the I/O power supply voltage within specifications? Details on the error can be read from the Network Configurator.
-	-	-	-	-				When dual channels are set: An error occurred in the other channel.	

: Lit : Flashing : Not lit

6-2 Troubleshooting

I/O errors can be read out from safety input status, test output status, and safety output status.

Status data when I/O is normal: ON (1)

Status data when an error occurs I/O: OFF (0)

The details of errors can be read out by using explicit messages and the Network Configurator.

Note: For I/O error latch time settings, the OFF status is maintained for at least the error latch time (0 to 65,530 ms, in increments of 10 ms) when individual safety input status turns OFF.

6-2-1 Safety Input Errors

Code	Error	Probable cause	Countermeasure
01 hex	Invalid configuration	The configuration is invalid.	Configure the DST1 correctly.
02 hex	External test signal failure	1) The power source (positive side) is in contact with the input signal line. 2) Short-circuit between input signal lines 3) Trouble with the connected device	1) 2) Check the wiring. 3) Replace the connected device.
03 hex	Internal input failure	Trouble with the internal circuits	Replace the DST1 if the system failure still occurs after turning the power supply ON again.
04 hex	Discrepancy error	1) Ground fault or break in an input signal line 2) Trouble with the connected device 3) The discrepancy time setting is not satisfied.	1) Check the wiring. 2) Replace the connected device. 3) Change the time setting.
05 hex	Error in the other dual channel input	Dual channels are set and an error occurred in the other channel.	Remove the error in the other channel.

Explicit Message for Reading the Cause of the Error

Explicit message	Read/write	Function	Command					Response
			Service code	Class ID	Instance ID	Attribute ID	Data size	
Safety Input Cause of Error Information Read	Read	Reads the cause for the normal flag (1 to 12) specified by the instance ID turning OFF. (See note.)	0E hex	3D hex	01 to 0C hex	6E hex	–	0: No error 01 hex: Configuration invalid 02 hex: External test signal failure 03 hex: Internal input failure 04 hex: Discrepancy error 05 hex: Error in the other dual channel input

Note: The instance numbers for safety inputs 0 to 11 are 1 to 12 (01 to 0C hex), respectively.

6-2-2 Test Output Errors

Code	Error	Probable cause	Countermeasure
01 hex	Invalid configuration	The configuration is invalid.	Configure the DST1 correctly.
02 hex	Overload detected	1) Ground fault or short-circuit of an output signal line 2) Trouble with the connected device	1) Check the wiring. 2) Replace the connected device.
05 hex	Output ON error	1) The power source (positive side) is in contact with the output signal line. 2) Trouble with the internal circuit	1) Check the wiring. 2) Replace the DST1.
06 hex	Undercurrent detected using muting lamp	Trouble with the connected device	Replace the connected device.

Explicit Message for Reading the Cause of the Error

Explicit message	Read/write	Function	Command					Response
			Service code	Class ID	Instance ID	Attribute ID	Data size	
Test Output Cause of Error Information Read	Read	Reads the cause for the normal flag (1 to 4) specified by the instance ID turning OFF. (See note.)	0E hex	09 hex	01 to 04 hex	76 hex	-	0 = No error 01 hex: Configuration invalid 02 hex: Overload detected 05 hex: Output ON error 06 hex: Undercurrent detected using muting lamp

Note: The instance numbers for test outputs 0 to 3 are 1 to 4 (01 to 04 hex), respectively.

6-2-3 Safety Output Errors

Code	Error	Probable cause	Countermeasure
01 hex	Invalid configuration	The configuration is invalid.	Configure the DST1 correctly.
02 hex	Over current detected	Trouble with the connected device	Replace the connected device.
03 hex	Short-circuit detected	Ground fault of the output signal line	Check the wiring.
04 hex	Stuck-at-high detected	1) The power source (positive side) is in contact with the output signal line. 2) Trouble with the internal circuit 3) The I/O power supply voltage is not within specifications.	1) Check the wiring. 2) Replace the DST1. 3) Make sure the I/O power supply voltage is within specifications.
05 hex	Error in the other dual channel output	Dual channels are set and an error occurred in the other channel.	Remove the error in the other channel.
06 hex	Internal relay relevant circuit error	Trouble with the internal circuit (MRD only)	Replace the DST1 if the system failure still occurs after turning the power supply ON again.
07 hex	Relay failure	Trouble with the relay (MRD only)	Replace the relay.
08 hex	Dual channel output failure	Wrong setting for output data	Check the program.
09 hex	Cross connection detected	Short-circuit between output signal lines.	Check the wiring.

Explicit Message for Reading the Cause of the Error

Explicit message	Read/write	Function	Command					Response
			Service code	Class ID	Instance ID	Attribute ID	Data size	
Safety Output Cause of Error Information Read	Read	Reads the cause for the normal flag (1 to 8) specified by the instance ID turning OFF. (See note.)	0E hex	3B hex	01 to 08 hex	6E hex	-	0: No error 01 hex: Configuration invalid 02 hex: Overcurrent detected 03 hex: Short-circuit detected 04 hex: Output ON error 05 hex: Error in the other dual channel output 06 hex: Internal relay relevant circuit error 07 hex: Relay failure 08 hex: Dual channel output failure 09 hex: Cross connection detected

Note: The instance numbers for safety outputs 0 to 7 are 1 to 8 (01 to 08 hex), respectively.

6-3 Error History

The DST1-series Safety I/O Terminals internally store up to 10 error history records. The history is updated each time an error occurs. When more than ten records exist, the oldest record will be deleted. The error history can be read using the Network Configurator.

Message	Countermeasure
DST1 Series System Failures	
System Failure	Check to see if the positive side of the power supply is in contact with the signal line. Replace the DST1 if the system failure still occurs after turning ON the power.
Configuration Invalid	Configure the DST1 correctly.
DeviceNet Communications Errors	
Switch Setting Mismatch	Check to see if the node address is the same as the node address used for the previous configuration. If not, set the node address to that of the previous configuration, or configure the DST1 again. If the error occurs again, replace the DST1.
Duplication MAC ID	Check the node addresses of other nodes. After setting the node addresses to eliminate address duplication, turn ON the power to the DST1 again.
Transmission Timeout	Check the following items. <ul style="list-style-type: none"> - Are cable lengths (trunk and branch lines) correct? - Are cables broken or loose? - Are Terminating Resistors connected to both ends of the trunk line and only to both ends of the trunk line? - Is noise interference excessive?
BusOff	
Standard IO Connection Timeout	
Safety I/O Connection Timeout	
Test Output Terminal-related Failures	
Stuck-at-high Detected at Test Output	Check to see if the positive side of the power source is in contact with the output signal line. If the wiring is okay, replace the DST1.
Overload Detected at Test Output	Check the wiring to see if a ground fault occurred in the output signal line.
Undercurrent is detected using muting lamp	Check the wiring to see if an output signal line is broken. If the wiring is okay, replace the external lamp.
Safety Input Terminal-related Failures	
Discrepancy Error at Safety Input	Check the following points: ·Make sure the input signal wire is not contacting the positive side of the power source. ·Make sure the input signal wire does not have an earth fault. ·Make sure the input signal wire is not disconnected. ·Make sure there is not a short circuit between input signal wires. ·Make sure a failure has not occurred in the connected device. ·Make sure the set value of the discrepancy time is valid. To recover from these failures, the following conditions are required: The latch input error time must have passed, and the cause of the error must have been removed. The target safety input terminal inputs must turn OFF. When changing the discrepancy time, reconfiguration is required.
External Connected Device at Safety Input	

Message	Countermeasure
Internal Input Error at Safety Input	- Replace the DST1 if the system failure still occurs after turning the power supply ON again.
Safety Output Terminal-related Failures	
Cross Connection Detected at Safety Output	Check the following points: ·Make sure there is no overcurrent for the output. ·Make sure the output signal wire does not have an earth fault. ·Make sure the output signal wire is not contacting the positive side of the power supply. ·Make sure there is not a short circuit between output signal wires. ·Make sure the power supply voltage is set within the specification range. To recover from these failures, the following conditions are required: The latch output error time must have passed, and the cause of the error must have been removed. The output signal from the user application for the target safety output must turn OFF.
Stuck-at-high Detected at Safety Output	
Short Circuit Detected at Safety Output	
Over Current Detected at Safety Output	
Dual Channel Output failure	Check the program to see if output data for dual channels are the same.
Internal Relay Relevant Circuit Error	- Check whether noise interference is excessive.
Relay Failure	Replace the safety relay.
Maintenance Information	
Total On Time or Contact Operation Counter Exceeded Threshold	---
Operation Time Exceeded Threshold	---
Unit Conduction Time Exceeded Threshold	---
Network PS Voltage Fell Below Threshold	---
Error Related to Power Supply for I/O	
Output PS Voltage Low	Check the following items. - Are cables broken? - Is the power supply voltage within specifications?
Input PS Voltage Low	

6-4 Maintenance

This section describes the routine cleaning and inspection recommended as regular maintenance. Handling methods when replacing the DST1-series Safety I/O Terminals are also explained here.

6-4-1 Cleaning

Clean the DST1-series Safety I/O Terminals regularly as described below to keep the network in optimal operating condition.

- Wipe the DST1-series Safety I/O Terminals with a dry, soft cloth for regular cleaning.
- When dust or dirt cannot be removed with a dry cloth, dampen the cloth with a neutral cleanser (2%), wring out the cloth, and wipe the DST1-series Safety I/O Terminals.
- Smudges may remain on the DST1-series Safety I/O Terminals from gum, vinyl, or tape that was left on for a long time. Remove these smudges when cleaning.

Note: Never use volatile solvents, such as paint thinner or benzene, or chemical wipes to clean

the DST1-series Safety I/O Terminals. These substances may damage the surface of the DST1-series Safety I/O Terminals.

6-4-2 Inspection

Inspect the system periodically to keep it in optimal operating condition.

In general, inspect the system once every 6 to 12 months, but inspect more frequently if the system is used in high-temperature, humid, or dusty conditions.

Inspection Equipment

Prepare the following equipment before inspecting the system.

Equipment Required for Regular Inspection

Phillips screwdriver

A flat-blade screwdriver

A screwdriver for connecting communications connectors

A tester (or a digital voltmeter)

Industrial alcohol and a clean cloth

Other Equipment That May Be Required

A synchroscope

An oscilloscope

A thermometer or hygrometer

Inspection Procedure

Check the items in the following table and correct any condition that is below standard.

Inspection item	Details	Standard	Equipment
Environmental conditions	Are ambient and panel temperatures correct?	Refer to the specifications for each DST1.	Thermometer
	Are ambient and panel humidity correct?	Refer to the specifications for each DST1.	Hygrometer
	Has dust or dirt accumulated?	No dust or dirt	Visual inspection
Installation conditions	Is the DST1 installed securely?	No looseness	Phillips screwdriver
	Are the connectors of the communications cables fully inserted?	No looseness	A flat-blade screwdriver
	Are the external wiring screws tight?	No looseness	A flat-blade screwdriver
	Are the connecting cables undamaged?	No external damage	Visual inspection
Safety relay operation	Does the safety relay contact go to OFF state?	No welded contacts	Visual inspection

IMPORTANT • *The maintenance interval for the relay contacts must not exceed a period of 6 month to meet safety category 4 in accordance with EN 954-1.*

- *The G7SA-2A2B must be used when replacing safety relays.*

6-4-3 Replacing the DST1

The network consists of the DeviceNet Unit (master) and DST1 Terminals. The entire network is affected when a DST1 is faulty, so a faulty DST1 must be repaired or replaced quickly. We recommend having spare DST1 Terminals available to restore network operation as quickly as possible.

Precautions for Replacing the DST1

Observe the following precautions when replacing a faulty DST1.

After replacement, make sure that there are no errors in the new DST1.

When a DST1 is being returned for repair, attach a detailed description of the problem and return the DST1 to your OMRON representative.

If there is a faulty contact, try wiping the contact with a clean, lint-free cloth dampened with alcohol.

Settings after Replacing a DST1

After replacing a DST1, set the new DST1's switches and configuration data to the same settings that were used on the old DST1.



WARNING

Safety functions may be impaired and serious injury may occasionally occur. When replacing a device, configure the replacement device suitably and confirm that it operate correctly.

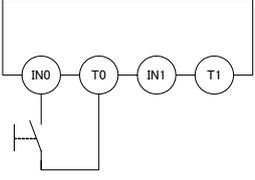
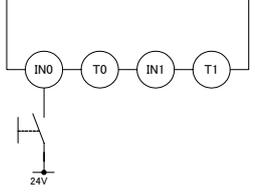
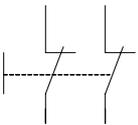
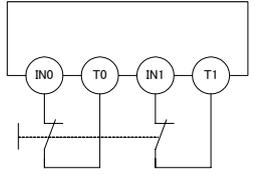
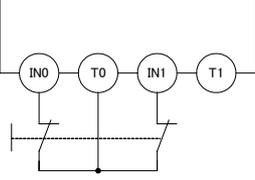
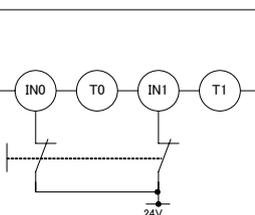
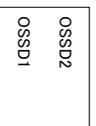
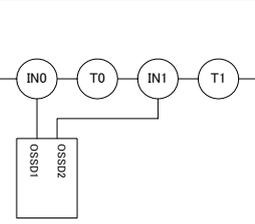


Section 7

Wiring Examples

7-1 Wiring and Configuration

The following table shows input device connection methods and configuration.

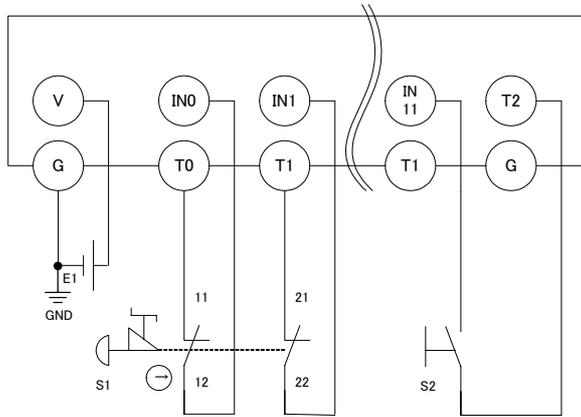
Connected device	Schematic diagram	Configuration
Reset switch 	Connect the switch between IN0 and T0. 	Safety Input used as "Single Channel input" without test output. Test output used as power supply output.
	Connect the switch between 24V DC and IN0. 	Safety Input used as "Single Channel input" without test output.
Emergency stop switch Door monitor 	Connect the switches between IN0 and T0, and IN1 and T1. 	Safety Inputs used as "Dual Channel input" with test output. Test outputs used as "Pulse Test Output".
	Connect the switches between T0 and IN0, IN. 	Safety Inputs used as "Dual Channel input" with test output. Test output used as "Pulse Test Output".
	Connect the switches between 24 V DC and IN0, IN1. 	Safety Inputs used as "Dual Channel input" without test output.
Safety Light Curtain 	Connect OSSD1 and OSSD2 to IN0 and IN1, respectively. 	Safety Inputs used as "Dual Channel input" without test output.

7-2 Examples of Wiring for Each Application

7-2-1 Emergency Stop Switch Dual Channel Inputs with Manual Reset

An example of the wiring and configuration when using the DST1-ID12SL-1 is shown below.

Wiring



- E1: 24-V DC Power Supply (S8□□)
- S1: Emergency Stop Switch (A165E or A22E) (positive opening mechanism)
- S2: Reset switch

Configuration

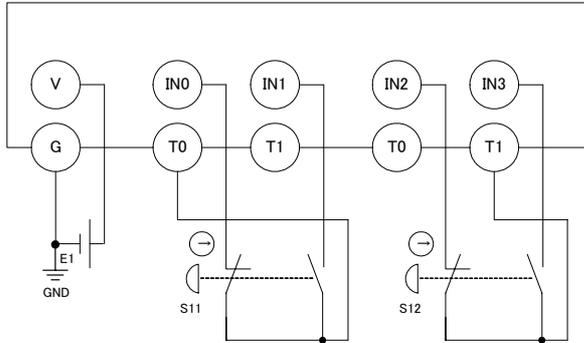
Parameter group	Parameter name		Value
Safety Input 0	0008	Safety Input 0 Channel Mode	Test pulse from test output
	0009	Safety Input 0 Test Source	Test Output 0
	0054	Dual Channel Safety Input 0/1 Mode	Dual Channel Equivalent
	0055	Dual Channel Safety Input 0/1 Discrepancy Time	100 x 10 ms
Safety Input 1	0012	Safety Input 1 Channel Mode	Test pulse from test output
	0013	Safety Input 1 Test Source	Test Output 1
Safety Input 11	0052	Safety Input 11 Channel Mode	Used as standard input
	0053	Safety Input 11 Test Source	Not Used
	0064	Dual Channel Safety Input 10/11 Mode	Single Channel
Test Output 0	0001	Test Output 0 Mode	Pulse Test Output
Test Output 1	0002	Test Output 1 Mode	Pulse Test Output
Test Output 2	0003	Test Output 2 Mode	Power Supply Output

7-2 Examples of Wiring for Each Application

7-2-2 Two-Hand Input

An example of the wiring and configuration when using the DST1-ID12SL-1 is shown below.

Wiring



E1: 24-V DC Power Supply (S8□□)
S11,S12: Two-hand control switches

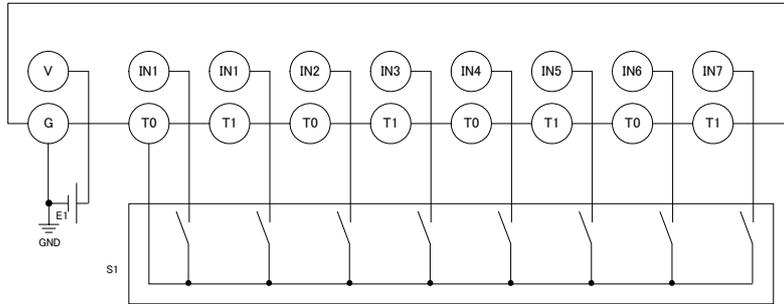
Configuration

Parameter Group	Parameter Name		Value
Safety Input 0	0008	Safety Input 0 Channel Mode	Test pulse from test output
	0009	Safety Input 0 Test Source	Test Output 0
	0054	Dual Channel Safety Input 0/1 Mode	Dual Channel Complementary
	0055	Dual Channel Safety Input 0/1 Discrepancy Time	100 x 10 ms
Safety Input 1	0012	Safety Input 1 Channel Mode	Test pulse from test output
	0013	Safety Input 1 Test Source	Test Output 0
Safety Input 2	0016	Safety Input 2 Channel Mode	Test pulse from test output
	0017	Safety Input 2 Test Source	Test Output 1
	0056	Dual Channel Safety Input 2/3 Mode	Dual Channel Complementary
	0057	Dual Channel Safety Input 2/3 Discrepancy Time	100 x 10 ms
Safety Input 3	0020	Safety Input 3 Channel Mode	Test pulse from test output
	0021	Safety Input 3 Test Source	Test Output 1
Test Output 0	0001	Test Output 0 Mode	Pulse Test Output
Test Output 1	0002	Test Output 1 Mode	Pulse Test Output

7-2-3 User Mode Switch Input

An example of the wiring and configuration when using the DST1-ID12SL-1 is shown below.

Wiring



E1: 24-V DC Power Supply
(S8□□)

S1: User mode switch

Configuration

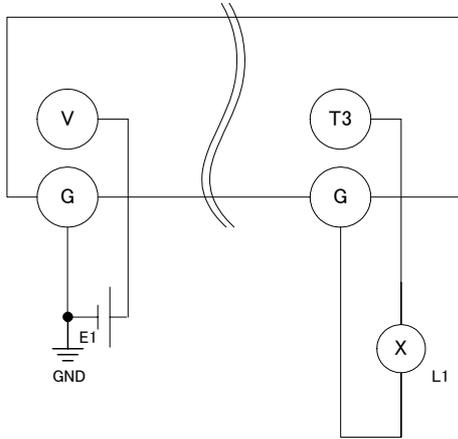
Parameter group	Parameter name		Value
Safety Input 0	0008	Safety Input 0 Channel Mode	Test pulse from test output
	0009	Safety Input 0 Test Source	Test Output 0
	0054	Dual Channel Safety Input 0/1 Mode	Single Channel
Safety Input 1	0012	Safety Input 1 Channel Mode	Test pulse from test output
	0013	Safety Input 1 Test Source	Test Output 0
Safety Input 2	0016	Safety Input 2 Channel Mode	Test pulse from test output
	0017	Safety Input 2 Test Source	Test Output 0
	0056	Dual Channel Safety Input 2/3 Mode	Single Channel
Safety Input 3	0020	Safety Input 3 Channel Mode	Test pulse from test output
	0021	Safety Input 3 Test Source	Test Output 0
Safety Input 4	0024	Safety Input 4 Channel Mode	Test pulse from test output
	0025	Safety Input 4 Test Source	Test Output 0
	0058	Dual Channel Safety Input 4/5 Mode	Single Channel
Safety Input 5	0028	Safety Input 5 Channel Mode	Test pulse from test output
	0029	Safety Input 5 Test Source	Test Output 0
Safety Input 6	0032	Safety Input 6 Channel Mode	Test pulse from test output
	0033	Safety Input 6 Test Source	Test Output 0
	0060	Dual Channel Safety Input 6/7 Mode	Single Channel
Safety Input 7	0036	Safety Input 7 Channel Mode	Test pulse from test output
	0037	Safety Input 7 Test Source	Test Output 0
Test Output 0	0001	Test Output 0 Mode	Pulse Test Output

7-2 Examples of Wiring for Each Application

7-2-4 Muting Lamp Output

An example of the wiring and configuration when using the DST1-ID12SL-1 is shown below.

Wiring



E1: 24-V DC Power Supply (S8□□)
L1: External muting lamp

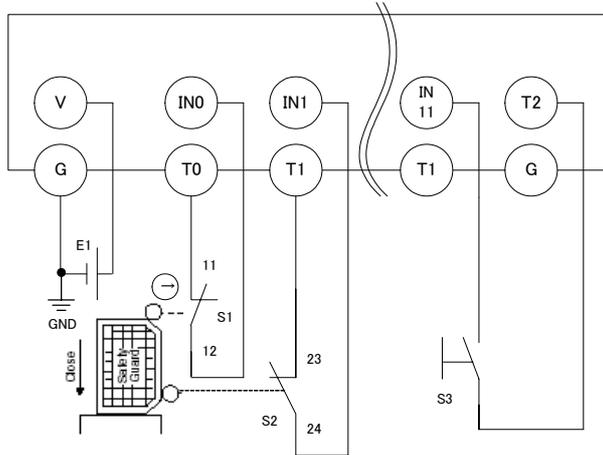
Configuration

Parameter group	Parameter name		Value
Test Output 3	0004	Test Output 3 Mode	Muting Lamp Output

7-2-5 Limit Switch Dual Channel Inputs and a Manual Reset

An example of the wiring and configuration when using the DST1-ID12SL-1 is shown below.

Wiring



- E1: 24-V DC Power Supply (S8□□)
- S1: Safety Limit Switch (D4D or D4B)
(positive opening mechanism)
- S2: Limit switch
- S3: Reset switch

Configuration

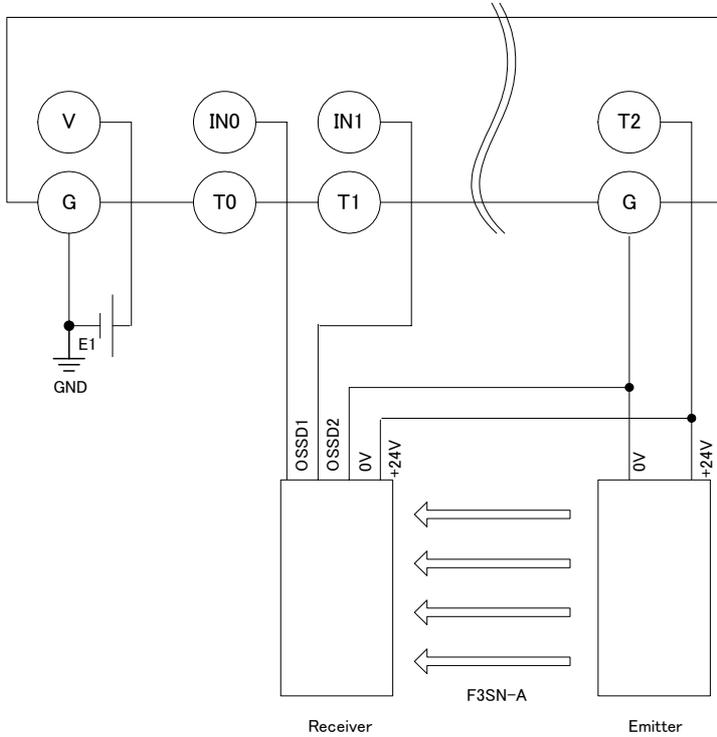
Parameter group	Parameter name		Value
Safety Input 0	0008	Safety Input 0 Channel Mode	Test pulse from test output
	0009	Safety Input 0 Test Source	Test Output 0
	0054	Dual Channel Safety Input 0/1 Mode	Dual Channel Equivalent
	0055	Dual Channel Safety Input 0/1 Discrepancy Time	100 x 10 ms
Safety Input 1	0012	Safety Input 1 Channel Mode	Test pulse from test output
	0013	Safety Input 1 Test Source	Test Output 1
Safety Input 11	0052	Safety Input 11 Channel Mode	Used as standard input
	0053	Safety Input 11 Test Source	Not Used
	0064	Dual Channel Safety Input 10/11 Mode	Single Channel
Test Output 0	0001	Test Output 0 Mode	Pulse Test Output
Test Output 1	0002	Test Output 1 Mode	Pulse Test Output
Test Output 2	0003	Test Output 2 Mode	Power Supply Output

7-2 Examples of Wiring for Each Application

7-2-6 Safety Light Curtain Input

An example of the wiring and configuration when using the DST1-ID12SL-1 is shown below.

Wiring



E1: 24-V DC Power Supply (S8□□)
F3SN-A: Safety Light Curtain

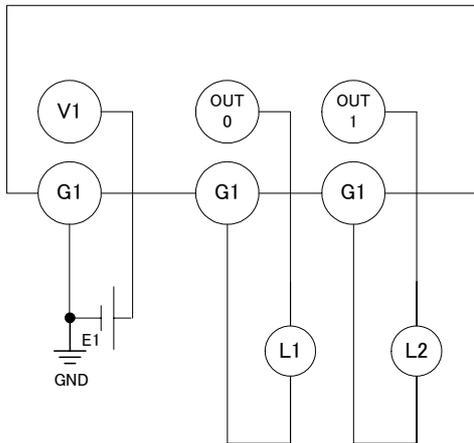
Configuration

Parameter group	Parameter name		Value
Safety Input 0	0008	Safety Input 0 Channel Mode	Used as safety input
	0009	Safety Input 0 Test Source	Not Used
	0054	Dual Channel Safety Input 0/1 Mode	Dual Channel Equivalent
	0055	Dual Channel Safety Input 0/1 Discrepancy Time	100 x 10 ms
Safety Input 1	0012	Safety Input 1 Channel Mode	Used as safety input
	0013	Safety Input 1 Test Source	Not Used
Test Output 2	0003	Test Output 2 Mode	Power Supply Output

7-2-7 Semiconductor Outputs for Dual Channel Mode

An example of the wiring and configuration when using the DST1-MD16SL-1 is shown below.

Wiring



E1: 24-V DC Power Supply (S8□□)

L1, L2: Loads

Configuration

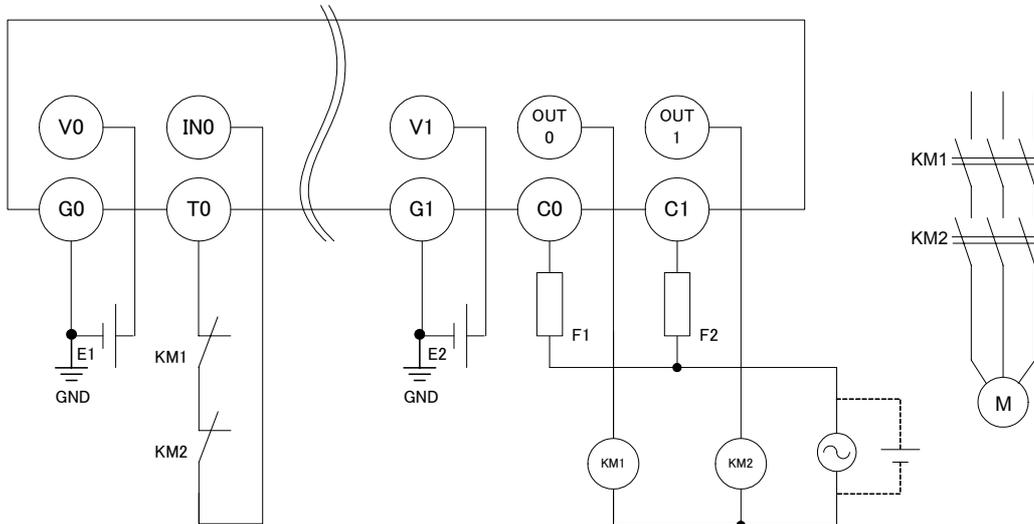
Parameter Group	Parameter Name		Value
Safety Output 0	0006	Safety Output 0 Channel Mode	Safety Pulse Test
	0014	Dual Channel Safety Output 0/1 Mode	Dual Channel
Safety Output 1	0007	Safety Output 1 Channel Mode	Safety Pulse Test

7-2 Examples of Wiring for Each Application

7-2-8 Relay Outputs with Dual Channel Mode and EDM Input

An example of the wiring and configuration when using the DST1-MRD08SL-1 is shown below.

Wiring



E1, E2: 24-V DC Power Supply (S8□□)

KM1, KM2: Magnetic Contactors

M: 3-phase motor

F1, F2: Fuses

Configuration

Parameter Group	Parameter Name		Value
Safety Input 0	0015	Safety Input 0 Channel Mode	Test pulse from test output
	0016	Safety Input 0 Test Source	Test Output 0
	0029	Dual Channel Safety Input 0/1 Mode	Single Channel
Test Output 0	0001	Test Output 0 Mode	Pulse Test Output
Safety Output 0	0006	Safety Output 0 Channel Mode	Used
	0010	Dual Channel Safety Output 0/1 Mode	Dual Channel
Safety Output 1	0007	Safety Output 1 Channel Mode	Used

Appendices

Appendix 1: DeviceNet Explicit Messages

DeviceNet explicit messages sent from the Master Unit to the DST1-series Safety I/O Terminals can be used to read or write any parameter of a specified DST1-series Safety I/O Terminals. The DST1-series Safety I/O Terminals processes the commands sent from the master and then returns responses.

A-1-1 Basic Format of Explicit Messages

The basic format of each command and response is shown below.

Command Block

Destination node address	Service code	Class ID	Instance ID	Attribute ID	Data
--------------------------	--------------	----------	-------------	--------------	------

Destination Node Address

The node address of the Unit that is sending the explicit message is specified with one hexadecimal byte.

Service Code, Class ID, Instance ID, and Attribute ID

The parameters used for specifying the command, processing object, and processing content.

Note: The number of bytes designated for the class ID, instance ID, and attribute ID depend on the Master Unit. When sent from an OMRON DeviceNet Master, the class ID and instance ID are 2 bytes (4 digits) each, and the attribute ID is 1 byte (2 digits).

Data

Data is not required when a read command is used.

Response Block

Normal Response Block

Number of bytes received	Source node address	Service code	Data
--------------------------	---------------------	--------------	------

Error Response Block

Number of bytes received 0004 hex (fixed)	Source node address	Service code	Error code
--	---------------------	--------------	------------

Number of Bytes Received

The number of bytes received from the source node address is returned in hexadecimal. When an error response is returned for an explicit message, the number of bytes is always 0004 hex.

Source Node Address

The node address of the node from which the command was sent is returned in hexadecimal.

Service Code

For normal completions, the service code specified in the command with the leftmost bit turned ON is stored as shown in the following table.

Function	Command service code	Response service code
Read data	10 hex	90 hex
Write data	0E hex	8E hex
Reset	05 hex	85 hex
Save	16 hex	96 hex

When an error response is returned for an explicit message, the value is always 94 hex.

Data

Read data is included only when a read command is executed.

Error Code

The explicit message error code. For details, refer to the list of error codes in the following table.

Error Codes

Code	Error name	Cause
08FF	Service not supported	The service code is incorrect.
09FF	Invalid attribute value	The specified attribute value is not supported. The data written was outside the valid range.
16FF	Object does not exist	The specified Instance ID is not supported.
15FF	Too much data	The data is larger than the specified size.
13FF	Not enough data	The data is smaller than the specified size.
0CFF	Object state conflict	The specified command cannot be executed due to an internal error.
20FF	Invalid parameter	The specified operation command data is not supported.
0EFF	Attribute not settable	An attribute ID supported only for reading has been executed for a write service code.
10FF	Device state conflict	The specified command cannot be executed due to an internal error.
14FF	Attribute not supported	The specified attribute is not supported.
19FF	Store operation failure	The data cannot be stored in memory.
2AFF	Group 2 only server general failure	The specified command or attribute is not supported or the attribute was not set.

A-1-2 Explicit Messages

Reading General Status

Explicit message	Read/write	Function	Command					Response
			Service code	Class ID	Instance ID	Attribute ID	Data size	
General Status Read	Read	Reads the specified slave's status flags (8 bits)	0E hex	95 hex	01 hex	65 hex	–	1 byte

Setting and Monitoring the Unit Conduction Time

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Unit Maintenance Set Value	Read	Reads the set value for the Unit Conduction Time (unit: 0.1 h).	0E hex	95 hex	01 hex	73 hex	–	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)
	Write	Writes the set value for the Unit Conduction Time (unit: 0.1 h).	10 hex	95 hex	01 hex	73 hex	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)	
Unit Maintenance Present Value	Read	Reads the present value for the Unit Conduction Time (unit: 0.1 h).	0E hex	95 hex	01 hex	71 hex		4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)
Unit Maintenance Flag	Read	Reads the monitor status of Unit Conduction Time.	0E hex	95 hex	01 hex	72 hex		1 byte 00 hex: Within range 01 hex: Over range (over the monitor value)

Setting and Monitoring a Safety Input

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Terminal Maintenance Information Monitor Mode	Read	Reads the monitor mode for maintenance information of the input (1 to 12) specified by the instance ID.	0E hex	3D hex	01 to 0C hex	65 hex		1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode
	Write	Writes the monitor mode for maintenance information of the input (1 to 12) specified by the instance ID.	10 hex	3D hex	01 to 0C hex	65 hex	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode	
Input Set Value for Total ON Time or Contact Operation Counter	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the input (1 to 12) specified by the instance ID.	0E hex	3D hex	01 to 0C hex	68 hex		4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)
	Write	Writes the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the input (1 to 12) specified by the instance ID.	10 hex	3D hex	01 to 0C hex	68 hex	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)	
Input Total ON Time or Contact Operation Counter Read	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the input (1 to 12) specified by the instance ID.	0E hex	3D hex	01 to 0C hex	66 hex		4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)
Input Total ON Time or Contact Operation Counter Reset	Reset	Resets the total ON time or number of contact operations (unit: operations) for time input (1 to 32) specified by the instance ID.	05 hex	3D hex	01 to 0C hex	66 hex		
Input Monitor Status for Total ON Time or Contact Operation Counter Read	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the input (1 to 12) specified by the instance ID.	0E hex	3D hex	01 to 0C hex	67 hex		1 byte 00 hex: Within range 01 hex: Over range (over the monitor value)

Appendix 1: DeviceNet Explicit Messages

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Safety Input Cause of Error Information Read	Read	Reads the cause for the normal flag (1 to 12) specified by the Instance ID turning OFF.	0E hex	3D hex	01 to 0C hex	6E hex		0: No error 01 hex: Configuration invalid 02 hex: External test signal failure 03 hex: Internal input failure 04 hex: Discrepancy error 05 hex: Error in the other dual channel input

Setting and Monitoring the Safety Output Point

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Terminal Maintenance Information Monitor Mode Read	Read	Reads the monitor mode for maintenance information of the output (1 to 8) specified by the instance ID.	0E hex	3B hex	01 to 08 hex	65 hex	–	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode
	Write	Writes the monitor mode for maintenance information of the output (1 to 8) specified by the instance ID.	10 hex	3B hex	01 to 08 hex	65 hex	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode	–
Output Set Value for Total ON Time or Contact Operation	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the output (1 to 8) specified by the instance ID.	0E hex	3B hex	01 to 08 hex	68 hex	–	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)
	Write	Writes the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the output (1 to 8) specified by the instance ID.	10 hex	3B hex	01 to 08 hex	68 hex	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)	–
Output Total ON Time or Contact Operation Counter Read	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the output (1 to 8) specified by the instance ID.	0E hex	3B hex	01 to 08 hex	66 hex	–	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)

Appendix 1: DeviceNet Explicit Messages

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Output Total ON Time or Contact Operation Counter Reset	Reset	Resets the total ON time or number of contact operations for time output (1 to 8) specified by the instance ID.	05 hex	3B hex	01 to 08 hex	66 hex		
Output Monitor Status for Total ON Time or Contact Operation Counter Read	Read	Reads the set value for the total ON time or number of contact operations of the output (1 to 8) specified by the instance ID.	0E hex	3B hex	01 to 08 hex	67 hex	-	1 byte 00 hex: Within range 01 hex: Over range (over the monitor value)
Safety Output Cause of Error Information Read	Read	Reads the cause for the normal flag (1 to 8) specified by the Instance ID turning OFF.	0E hex	3B hex	01 to 08 hex	6E hex		0: No error 01 hex: Configuration invalid 02 hex: Overcurrent detected 03 hex: Short-circuit detected 04 hex: Stuck-at-high detected 05 hex: Error in the other dual channel output 06 hex: Internal relay relevant circuit error 07 hex: Relay failure 08 hex: Dual channel violation 09 hex: Cross connection detected

Setting and Monitoring the Test Output Point

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Terminal Maintenance Information Monitor Mode Read	Read	Reads the monitor mode for maintenance information of the output (1 to 4) specified by the instance ID.	0E hex	09 hex	01 to 04 hex	65 hex	–	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode
	Write	Writes the monitor mode for maintenance information of the output (1 to 4) specified by the instance ID	10 hex	09 hex	01 to 04 hex	65 hex	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode	–
Output Set Value for Total On Time or Contact Operation	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the output (1 to 4) specified by the instance ID.	0E hex	09 hex	01 to 04 hex	68 hex	–	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)
	Write	Writes the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the output (1 to 4) specified by the instance ID.	10 hex	09 hex	01 to 04 hex	68 hex	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)	–
Output Total ON Time or Contact Operation Counter Read	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the output (1 to 4) specified by the instance ID.	0E hex	09 hex	01 to 04 hex	66 hex	–	4 bytes 0000 0000 to FFFF FFFF hex (0 to 4,294,967,295)
Output Total ON Time or Contact Operation Counter Reset	Reset	Resets the total ON time or number of contact operations for time output (1 to 4) specified by the instance ID.	05 hex	09 hex	01 to 04 hex	66 hex		
Output Monitor Status for Total ON Time or Contact Operation Counter Read	Read	Reads the set value for the total ON time or number of contact operations (unit: operations) of the output (1 to 4) specified by the instance ID.	0E hex	09 hex	01 to 04 hex	67 hex	–	1 byte 00 hex: Within range 01 hex: Over range (over the monitor value)

Appendix 1: DeviceNet Explicit Messages

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Safety Output Cause of Error Information Read	Read	Reads the cause for the normal flag (1 to 8) specified by the Instance ID turning OFF.	0E hex	09 hex	01 to 04 hex	76 hex		0 = No error 01 hex: Configuration invalid 02 hex: Overload detected 05 hex: Stuck-at-high detected 06 hex: Undercurrent detected for muting lamp

Setting and Monitoring Operation Time

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Set Value for Operation Time Monitor	Read	Reads the monitor value for the time (unit: ms) from when the output (1 to 8) specified by the instance ID turns ON until the corresponding input turns ON.	0E hex	97 hex	01 to 10 hex	67 hex	–	2 bytes 0000 to FFFF hex (0 to 65535)
	Write	Writes the monitor value for the time (unit: ms) from when the output (1 to 8) specified by the instance ID turns ON until the corresponding input turns ON.	10 hex	97 hex	01 to 10 hex	67 hex	2 bytes 0000 to FFFF hex (0 to 65535)	
Present Value for Operation Time Monitor	Read	Reads the present value for the time (unit: ms) from when the output (1 to 8) specified by the instance ID turns ON until the corresponding input turns ON.	0E hex	97 hex	01 to 10 hex	65 hex	–	2 bytes 0000 to FFFF hex (0 to 65535)
Monitor Status Value for Operation Time Monitor Read	Read	Reads the monitor status for the time (unit: ms) from when the output (1 to 8) specified by the instance ID turns ON until the corresponding input turns ON.	0E hex	97 hex	01 to 10 hex	66 hex	–	1 byte 00 hex: Within range 01 hex: Over range (over the monitor value)

Appendix 1: DeviceNet Explicit Messages

Setting Hold/Clear for Communications Errors (Test Output)

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Setting for Output Status (Hold or Clear) after Communications Error	Read	Reads whether hold or clear is set as the output status after a communications error for the output (1 to 32) specified by the instance ID. The setting can be read for a specified number of points.	0E hex	09 hex	01 to 04 hex	05 hex	–	1 byte 00 hex: Clear 01 hex: Hold
Setting for Output Status (Hold or Clear) after Communications Error	Write	Sets either hold or clear as the output status after a communications error for an output (1 to 32) specified by the instance ID. The setting can be read for a specified number of points.	10 hex	09 hex	01 to 04 hex	05 hex	1 byte 00 hex: Clear 01 hex: Hold	

Note: The default setting is for all outputs to be cleared (0).

Writing Maintenance Information

Explicit message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data size	
Maintenance Counter Save	Save	Records the maintenance counter in the Slave's memory	16 hex	95 hex	01 hex	–	–	–

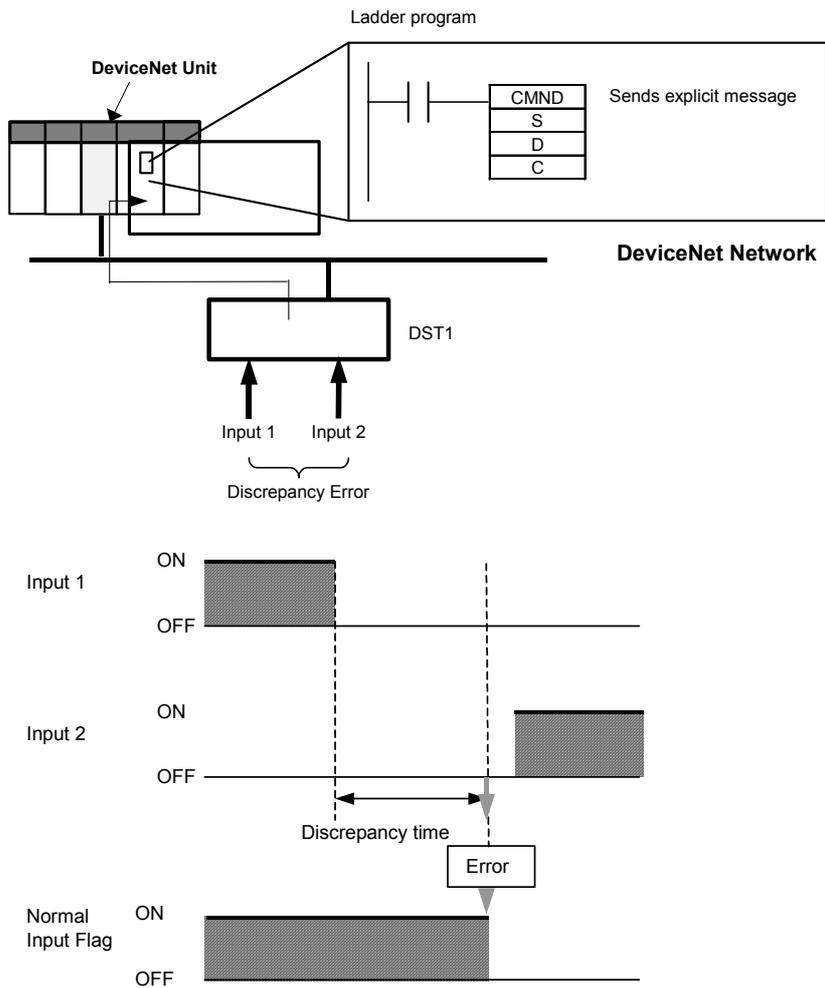
A-1-3 Using Explicit Messages

The following example shows how to use explicit messages with the DST1-series Safety I/O Terminals using a CS1W-DRM21 DeviceNet Unit (Master).

Example: Reading the Monitor Status for the Operation Time Monitor

Example Conditions

DeviceNet Unit node address: 05
 Unit number: 0
 Unit address: FE hex (or 10 hex)
 DST1 node address: 11



Appendix 1: DeviceNet Explicit Messages

Command Details

• [CMND S D C]

S: D01000

D (first response word): D02000

C: D00000

Contents of S

Address	Contents	Meaning
D01000	2801 hex	Command code
D01001	0B0E hex	DST1 node address: 11 Service code: 0E hex
D01002	003D hex	Class ID: 003D hex
D01003	0001 hex	Instance ID: 0001 hex
D01004	6E** hex	Attribute ID: 6E□□ hex (Set any value for the blank boxes.)

Contents of C

Address	Contents	Meaning
D00000	0009 hex	Number of bytes of command data
D00001	0009 hex	Number of bytes of response data
D00002	0000 hex	Destination DeviceNet Unit network address: 0
D00003	05FE hex	Destination DeviceNet Unit node address: 5 Destination DeviceNet Unit address: FE hex (or 10 hex)
D00004	0000 hex	Response required Communications port number: 0 Number of retries: 0
D00005	003C hex	Response monitoring time: 6 s

Response

Contents of D

Address	Contents	Meaning
D02000	2801 hex	
D02001	0000 hex	
D02002	0003 hex	
D02003	0B8E hex	Response source node address: 11 (0B hex) Normal completion: 8E hex
D02004	0400 hex	Safety input cause of error information: 0004 ↑ Discrepancy Error

Appendix 2: Calculated Values of PFD and PFH

Calculated values of PFD and PFH of the DST1-series Safety I/O Terminals are given in the following tables. These values must be calculated for the overall devices within the system to comply with the SIL level required for application.

A-2-1 Calculated PFD Values

Model	Proof test interval (years)	PFD
DST1-ID12SL-1	0.25	9.58E-07
	0.5	1.92E-06
	1	3.83E-06
	2	7.66E-06
DST1-MD16SL-1	0.25	1.21E-06
	0.5	2.41E-06
	1	4.82E-06
	2	9.64E-06
DST1-MRD08SL-1	0.25	5.81E-06
	0.5	1.18E-05

IMPORTANT *The proof test interval of the DST1-MRD08SL-1 must not exceed 0.5 years because the maintenance interval for the relay contacts must not exceed a period of 6 month to satisfy safety category 4 in accordance with EN 954-1.*

A-2-2 Calculated PFH Values

Model	PFH
DST1-ID12SL-1	8.75E-10
DST1-MD16SL-1	1.11E-09
DST1-MRD08SL-1	5.24E-09

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