

Optimizing industrial and  
safety networking

# DEVICENET SAFETY

breakthrough to seamless safe control systems



Advanced Industrial Automation

OMRON

DeviceNet is an innovative industrial network system that enables a wide range of devices to be easily networked and managed remotely. Everything – from PLCs and remote I/O, to fibre optic sensors, vision systems controllers, servos and inverters – can be seamlessly integrated into DeviceNet, making it one of the best industrial field buses around.

And the trend is for DeviceNet to become even more popular with end-users and OEMs who look for a simple yet effective solution to controlling their automation processes, no matter how complex.

# DeviceNet Safety offers more than a safe network

As a founding member of DeviceNet and specialist for machine safety, Omron is one of the few companies with expertise to combine innovative bus technology and safety to a seamless solution up to safety category 4 (EN 954-1) and SIL 3 (IEC 61508).



# DEVICENET SAFETY

## DeviceNet Safety

DeviceNet Safety is based on CIP safety messaging. It is an extension of the existing standard DeviceNet messaging. Standard and high integrity safety messaging coexist on the same network. Existing DeviceNet systems can easily be upgraded to safety messaging by just adding DeviceNet Safety components to the network.



## Omron's Smart Platform

Smart Platform demonstrates Omron to be one of the most innovative players in the market. Driven by the need to make connectivity as simple and flexible as possible, Omron's Smart Platform creates a harmonious combination of sensing, control, motion and regulation devices. It enables users to mix and match their preferred solutions without the need to worry about hierarchy or other communication issues. DeviceNet safety will be fully embedded in Smart Platform.

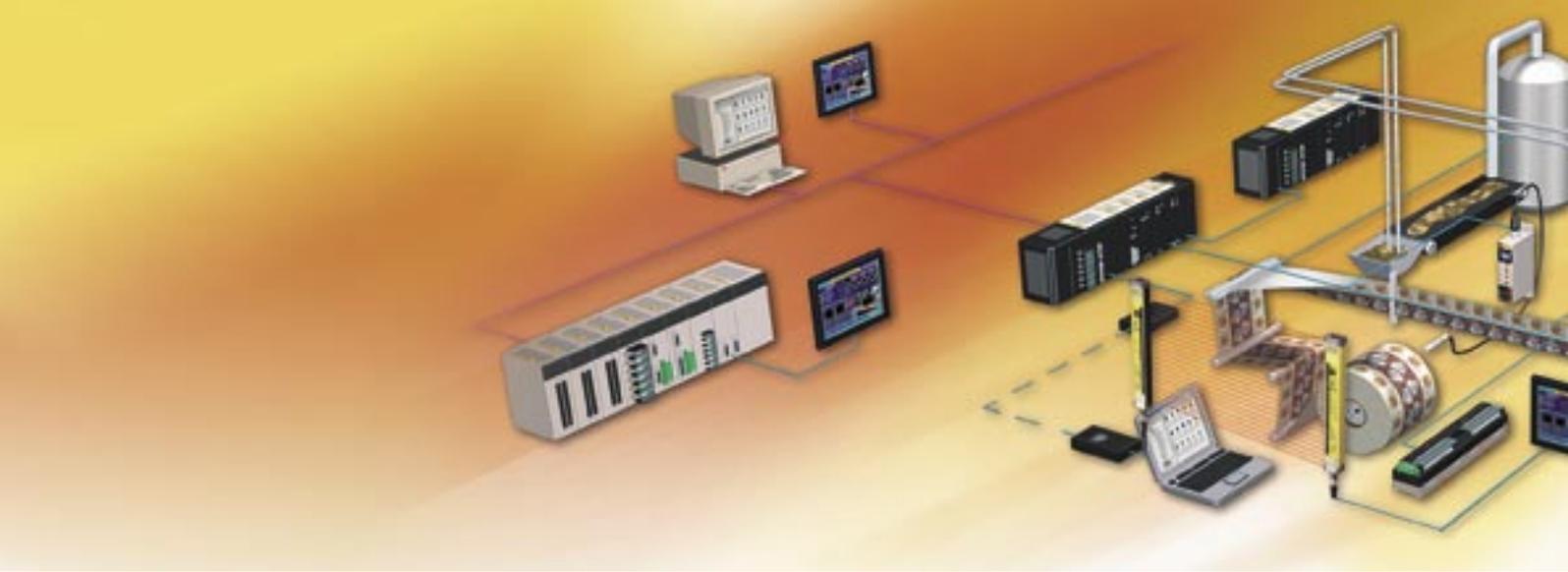
### The Smart Platform concept is built around three major advantages for the user:

- **One software**  
Omron offers one single programming and configuration environment to build up, configure and program networks, sensors, PLCs, HMIs and motion control systems.

## Features and benefits at a glance

- **An open communication standard**
  - Assures interoperability between standard and safety components.
- **Fast and easy installation**
  - Save time with an efficient programming tool based on predefined and certified function blocks.
  - Detachable cage clamp terminals are standard for easy installation and maintenance.
- **Future-ready for easy additions as your needs change**
  - DeviceNet Safety is designed for easy network additions to save your investment.
- **Smart, seamless and flexible**
  - DeviceNet Safety I/O-Modules support standard and safety mode on one module.
- **Reliable and safe**
  - Predictive maintenance and self diagnosis reduce downtime remarkably.

- **One connection**  
All that can be done by one single connection point either locally, through networks or from a modem connection. This allows remote access or servicing of your complete machine to become a reality.
- **One minute**  
SMART Active Parts greatly increase the functionality & information that is available to operators through Omron's HMI. Written and tested for you by Omron's control experts these "drag and drop" visualization objects are called Smart and Active because they automate the communication to all connected Omron products. When combined together programming, configuration and testing that previously required hours or days can be completed in minutes.



### Flexible safety control system

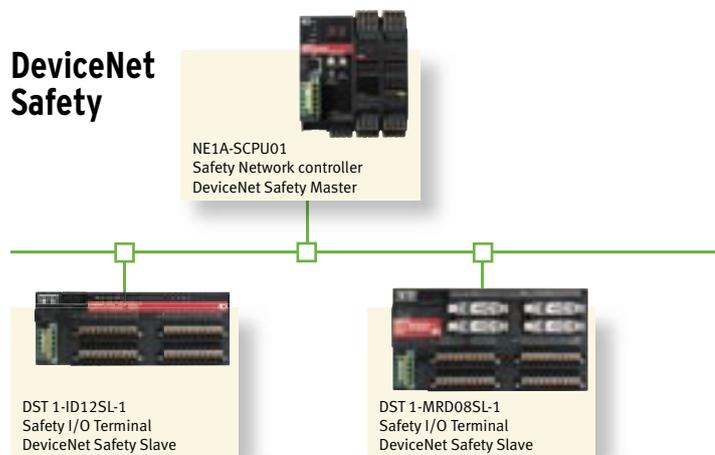
Using DeviceNet Safety offers benefits far before the need for a safety network is obvious in a given application. Where easy adoption of an already designed safety system in the life cycle and the expandability to additional machinery and safety requirements is premium, the stand-alone-functionality of the Safety Network Controller will convince you.

This safety control system can be expanded easily by adding DeviceNet Safety I/O-Modules. Now the Safety Network Controller works as DeviceNet Safety master and distributed safety in- and outputs are available.

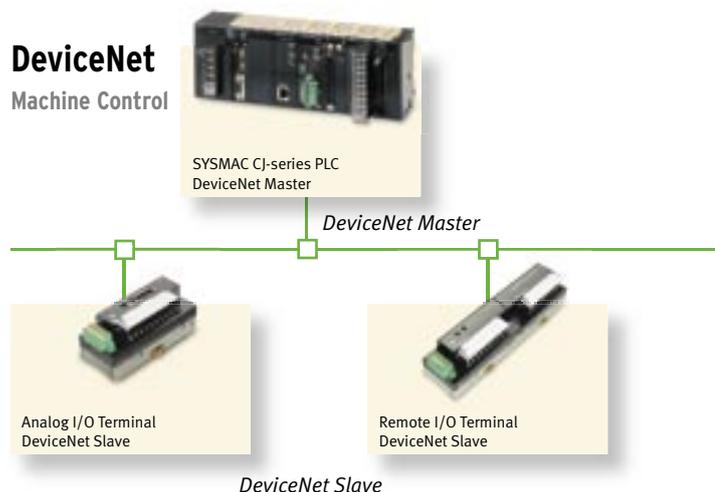
Maintenance or diagnosis information from the DeviceNet Safety system can be easily monitored on a DeviceNet Master, which can be easily connected to the DeviceNet Safety network. The Safety Network Controller can handle up to 16 DeviceNet Safety nodes in one network. Multiple Safety Network Controllers can coexist in one network as cascade and share the safety informations.

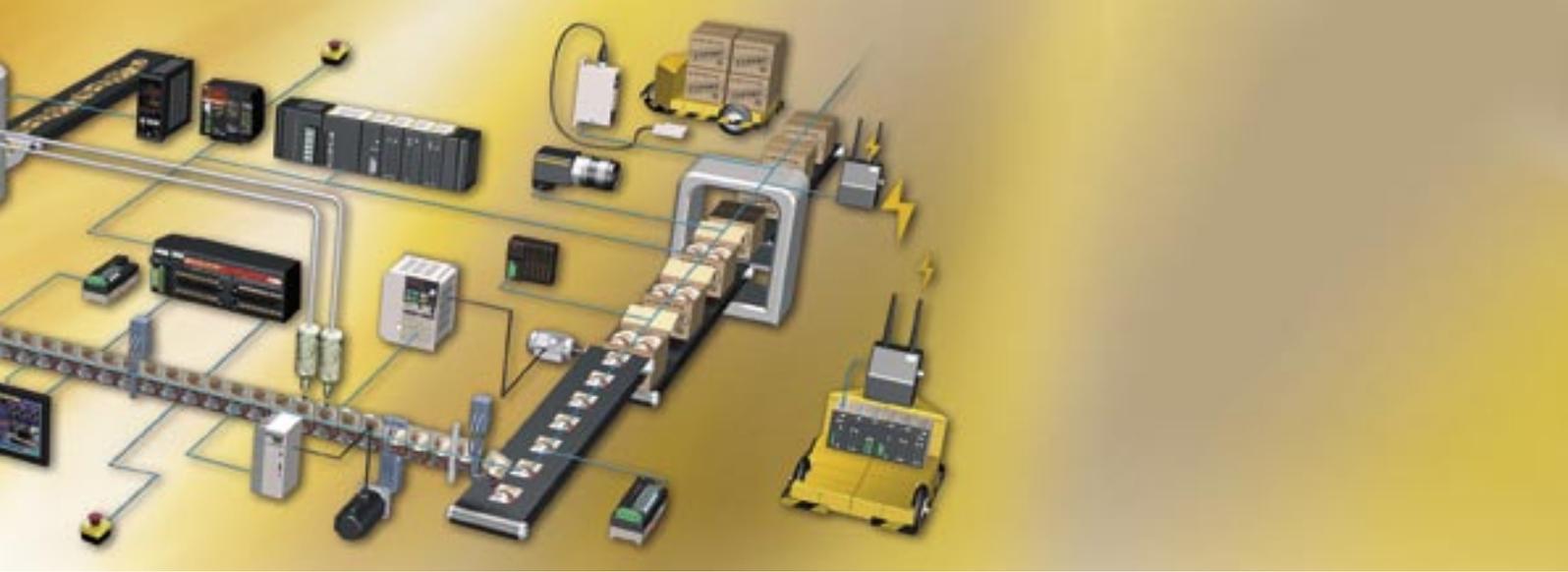


### DeviceNet Safety



### DeviceNet Machine Control





## Safety Network Controller, the heart of safety control

The Safety Network Controller hosts the safety application program, monitors the safety inputs and controls the safety outputs.

The simplest DeviceNet Safety based solution is using the Safety Network Controller stand alone.

The just 90mm wide housing of the controller offers 16 (8 redundant) safety inputs and 8 solid state outputs with 500mA rating and self test. Four additional test pulse outputs ensure crosstalk and short circuit detection for the input channels. All in- and outputs comply with IEC 61131-2 (type 2).

All terminals on the Safety Network Controller can be easily accessed. They are detachable in cage clamp technology.

Advanced diagnostic is provided by the Safety Network Controller. LED displays, status LEDs for all in- and outputs and the accessibility of the system status data via DeviceNet enables easy troubleshooting and predictive maintenance.

The Safety Network Controller manages up to 16 DeviceNet Safety slaves in one network. For more sophisticated systems, the Safety Network Controller can be configured to behave as a DeviceNet Safety slave or operate in a cascade of multiple Safety Network Controllers.



WS02-CFSC1-E  
Safety Network Configurator



NE1A-SCPU01  
Safety Network controller  
DeviceNet Safety Master



WS02-CFSC1-E  
Safety Network Configurator



DST-MD16SL-1  
Safety I/O Terminal  
DeviceNet Safety Slave

### Safety Control

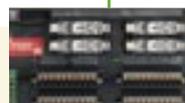


NE1A-SCPU01  
Safety Network controller  
DeviceNet Safety Master

*DeviceNet Safety Master*

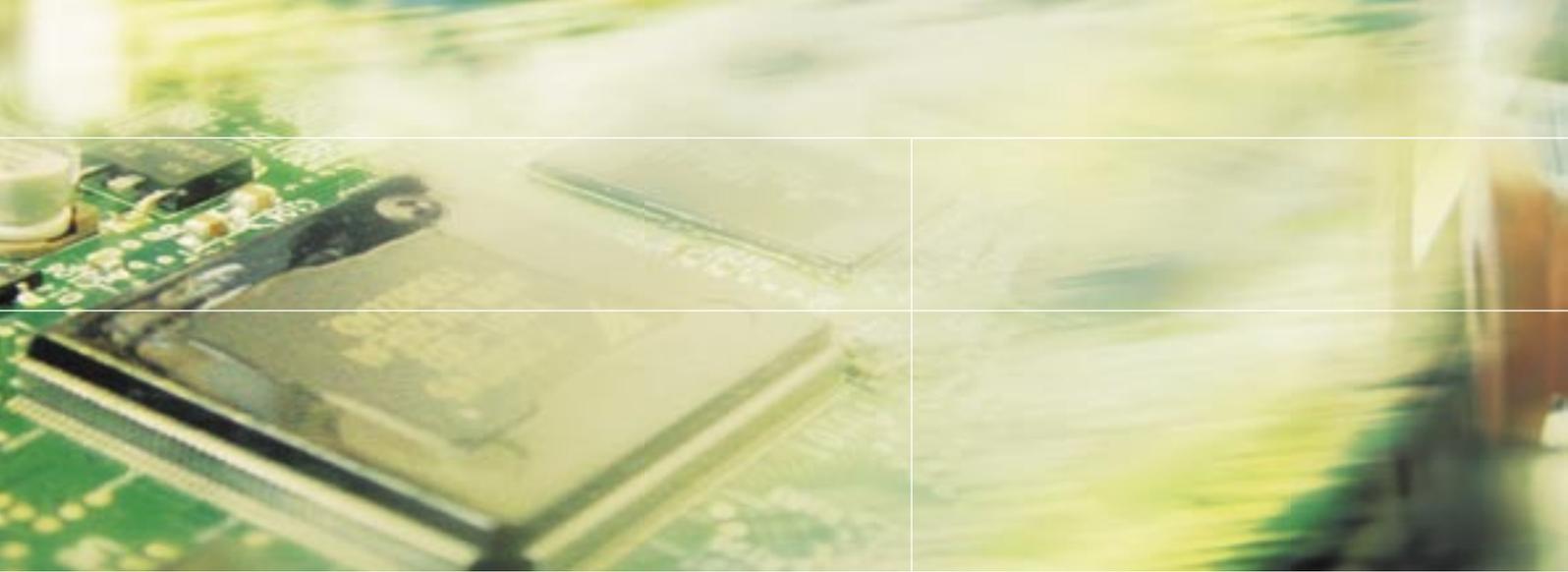


DST 1-ID12SL-1  
Safety I/O Terminal  
DeviceNet Safety Slave



DST 1-MRD08SL-1  
Safety I/O Terminal  
DeviceNet Safety Slave

*DeviceNet Safety Slave*



## DeviceNet Safety Terminals, eyes and hands of safety control

The DeviceNet Safety Terminals have been designed to provide highest flexibility for all your installations. All three models are fully certified for applications up to safety category 4 (EN 954-1) and SIL 3 (IEC 61508). All DeviceNet Safety Terminals have detachable cage clamp terminals.

- DeviceNet Safety Terminal DST1-ID12SL-1 has 12 inputs for safety signals. Four test pulse outputs ensure crosstalk and short circuit detection.

### Two models are equipped with safety outputs to directly drive contactors, valves and solenoids:

- DeviceNet Safety Terminal DST1-MD16SL-1 has eight solid state outputs, each with 500mA rating. Additionally there are eight inputs and 4 test pulse outputs available.
- DeviceNet Safety Terminal DST1-MRD08SL-1 has four safety relay outputs, each with 2A rating. All relays are exchangeable for easy maintenance. Additionally there are four inputs and four test pulse outputs on board.

### Unique features of all three models are:

- the bulb current monitor function by using a dedicated test output.
- mixed mode operation of the DeviceNet Safety Terminals. All in- and outputs can flexibly be assigned to the safety or standard part of the control system. If they are used for safety, the Safety Network Controller ensures system integrity. Smart slave functions like operation counters and monitoring of ON-time or operation time are fully supported.





## Configuration Software, it just works

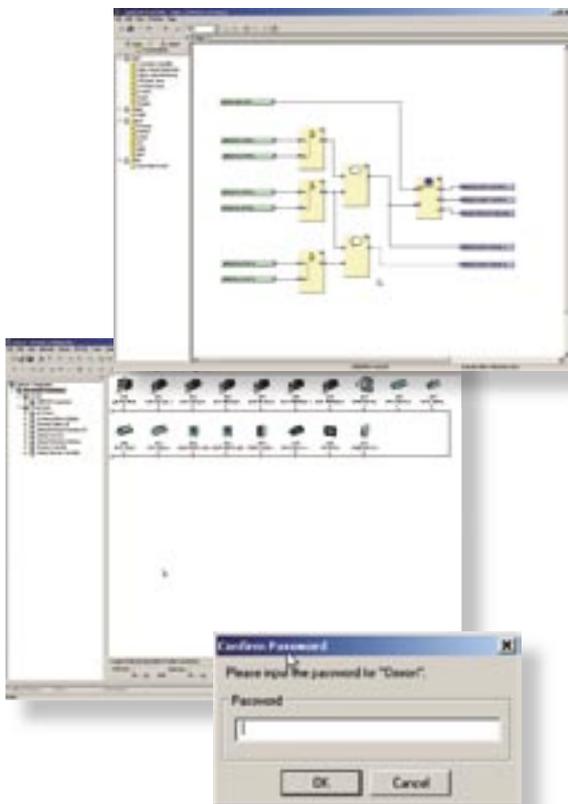
The DeviceNet Safety Configuration software has been designed for easy setup of the safety control system. Open the software and select all system components. For easy understandability, labels can be assigned to the internal signals and all in- and outputs.

By starting the logic editor, you can access the all predefined and certified function blocks.

### Available function blocks:

- E-stop
- Guard monitoring
- Light curtain monitoring
- Mode selector switch
- Two-Hand control
- Restart interlock
- External device monitoring
- ON-delay timer
- OFF-delay timer
- Logical AND-Gate
- Logical OR-Gate
- Logical EXOR-Gate
- Etc.

After configuring your system, just download the whole configuration via USB or a connected DeviceNet Master. For safety reasons, all configuration changes in the system are traced in the safety protocol. After verification and password protection of the configuration, your safety control system is ready for use.





## Meeting Safety requirements

The EU machinery directive 98/37/EC is the foundation for the safety of machinery within The European Union. Since 1995 these documents have had a major impact on safety for workers and work equipment. The directive contains more than 340 EN Norms. To meet these requirements, familiarity and know-how is required to ensure that safety is combined with good ergonomic and economic principles. Therefore efficient and innovative safety sensors and components are invaluable.

Omron works closely with many leading machinery manufactures and end users to develop practical solutions for industrial safety. From these solutions Omron has products for emergency stop applications, safety guard door monitoring and interlocking as well as safety sensors for finger, hand, limb and body protection. Our aim is to make the workplace a safer environment using cost-effective and ergonomically designed products.

DeviceNet Safety System

# NE1A/DST1

*Omron now offers a DeviceNet compatible Safety System, that can be used 3-ways: as a Stand-alone controller, as a Safety network expandable with remote I/O blocks, or combined with DeviceNet to form a combined Network.*

- Conforms to Global Safety Standards
- Individual I/O LED status and error indicators
- USB Programming Port
- IEC 61508 SIL 3
- EN954-1 Category 4
- UL1604 Class 1, Div. 2 Group A,B,C,D

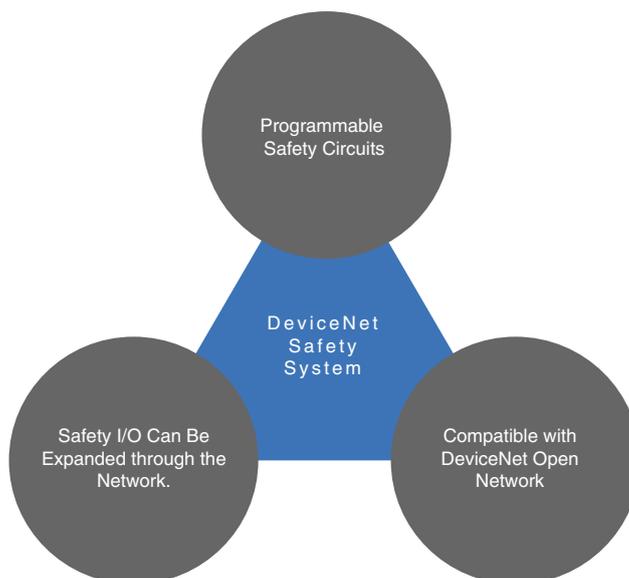


## Product Information

Introducing a Safety Network System that dramatically alters previous safety design.

Programmable safety circuits are incorporated to facilitate efficient designing and modifications. Moreover, Safety I/O Terminals can be added to increase safety I/O capacity for distributed allocation through the network. DeviceNet wiring on the existing network can be used as is, facilitating efficient design by expanding on the existing system.

The programmability of safety circuits, expandability of I/O using the network, and compatibility with the DeviceNet open network effects major changes to the framework of previous safety design systems.



Complies with the Highest Safety Standards in the world

The DeviceNet Safety System conforms to IEC 61508 SIL3 for functional safety, and EN 954-1 Category 4 for machine safety, complying with the world's highest level of safety standards.

IEC 61508 SIL 3

Safety circuits must be able to function to provide safety at anytime. Conversely, the degree of lack of safety is used as the indicator. In IEC 61508, safety is defined as the Probability of Failure per Hour, or PFH. Based on this, the SIL (Safety Level) is classified into four levels. SIL 3 indicates a probability of dangerous failure of once in 1,000 years, which is the highest level in machine safety.

EN 954-1 Safety Category 4

EN standards evaluate the level of machine risk and require the incorporation of risk minimization measures. In EN 954-1, five safety categories have been established, with Safety Category 4 indicating designs that require the highest safety design level. This category is demanded for machines with the highest level of danger, wherein "serious injury (severed limbs, death, etc.) will occur frequently, with little chance of escaping danger." This category demands that a single fault (failure) in any part of the machine, or a series of faults, will not lead to loss of the machine's safety functions.

NE1A-SCPU01 Safety Network Controller



Programmable Safety Control

- Incorporates 16 safety inputs and 8 safety outputs. Functions as a compact safety PLC even without using a network.
- Construct safety circuits easily with special Function Blocks.
- Up to 128 Function Blocks can be used.

DeviceNet Safety Communications Functions

- Provides DeviceNet Safety Master functionality. Connect up to 16 Safety Slaves. Expand using up to sixteen Input Slaves with 12 points each (192 points total) and eight I/O Slaves with 16 points each (128 points total).
- Safety Slave functionality is also included. Interlock control can be incorporated between Safety Network Controllers.

DeviceNet Slave Functionality

- Monitor safety I/O and status information from the DeviceNet Master.

DST1-series Safety I/O Terminals



Safety Input and Safety I/O Models Available

- Safety inputs: 12-point model (DST1-ID12SL-1)
- Safety I/O: 8-point/8-point model (DST1-MD16SL-1)
- Safety I/O: 4-point/4-point (relay outputs) model (DST1-MRD08SL-1)

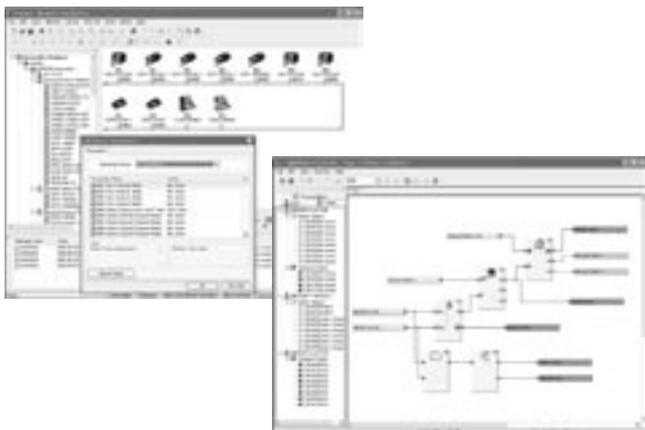
DeviceNet Slave Functionality

- Safety I/O and status information can be allocated as a DeviceNet Slave.
- Maintenance functions are provided for measuring the number of operations or the operating time for safety devices.

Easy Wiring

- Superior construction and preventive maintenance using clamp connectors.

WS02-CFSC1-E Safety Network Configurator



Network Configurator Functions

- Includes previous DeviceNet Configurator functions.
- Performs setup for the DeviceNet Safety network configuration.

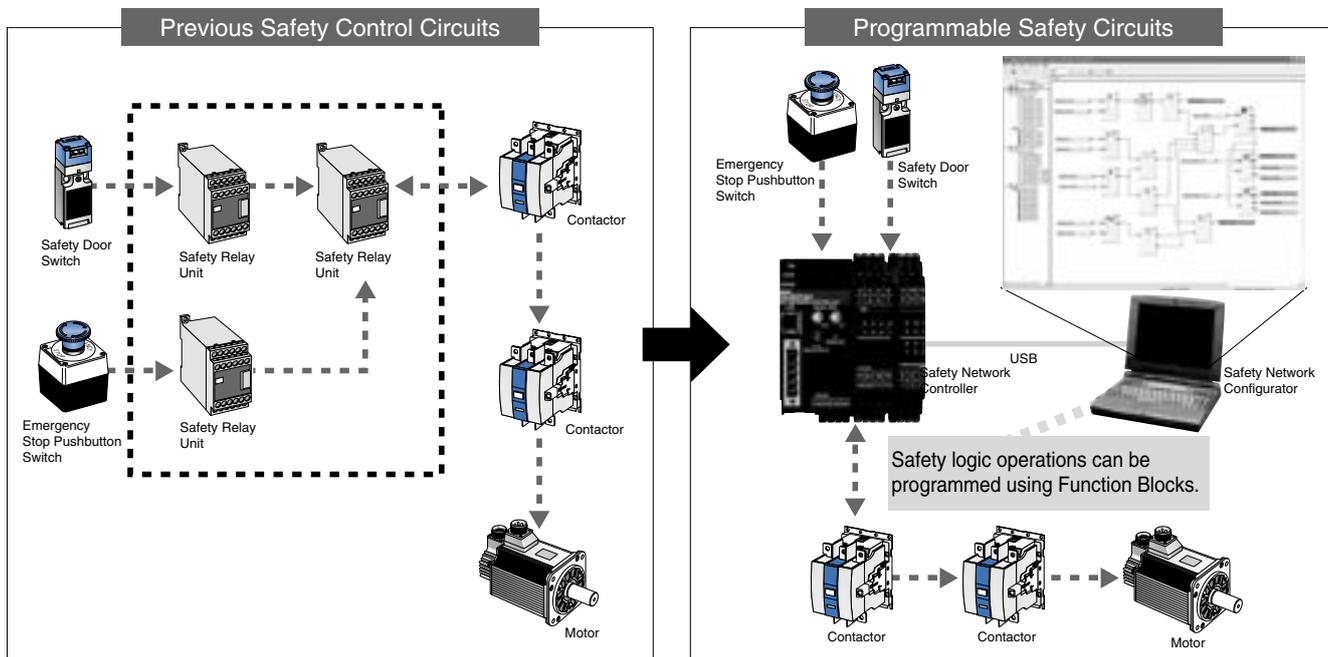
Programming Functions

- I/O configuration functions for Safety Network Controllers and Safety I/O Terminals.
- Programming functions for safety circuits.
- Monitor programs.

## Stand-Alone Programmable Controller

### Programmable Safety Circuits

Until now, safety design involved combining safety relays to configure safety control circuits. This process involved tedious wiring, and moreover, any changes required direct modification of the wiring. The DeviceNet Safety System uses programmable safety circuits, dramatically improving the ease of design and modification.

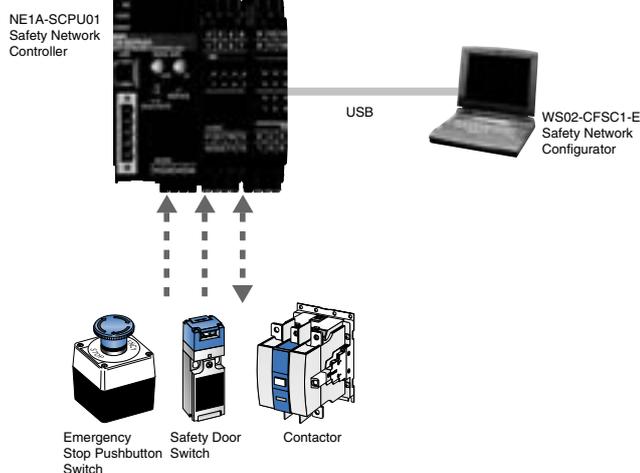


### System Configuration 1

Configuration Example for High-speed Safety I/O Response Using Small Number of Points

- NE1A-SCPU01
- WS02-CFSC1-E

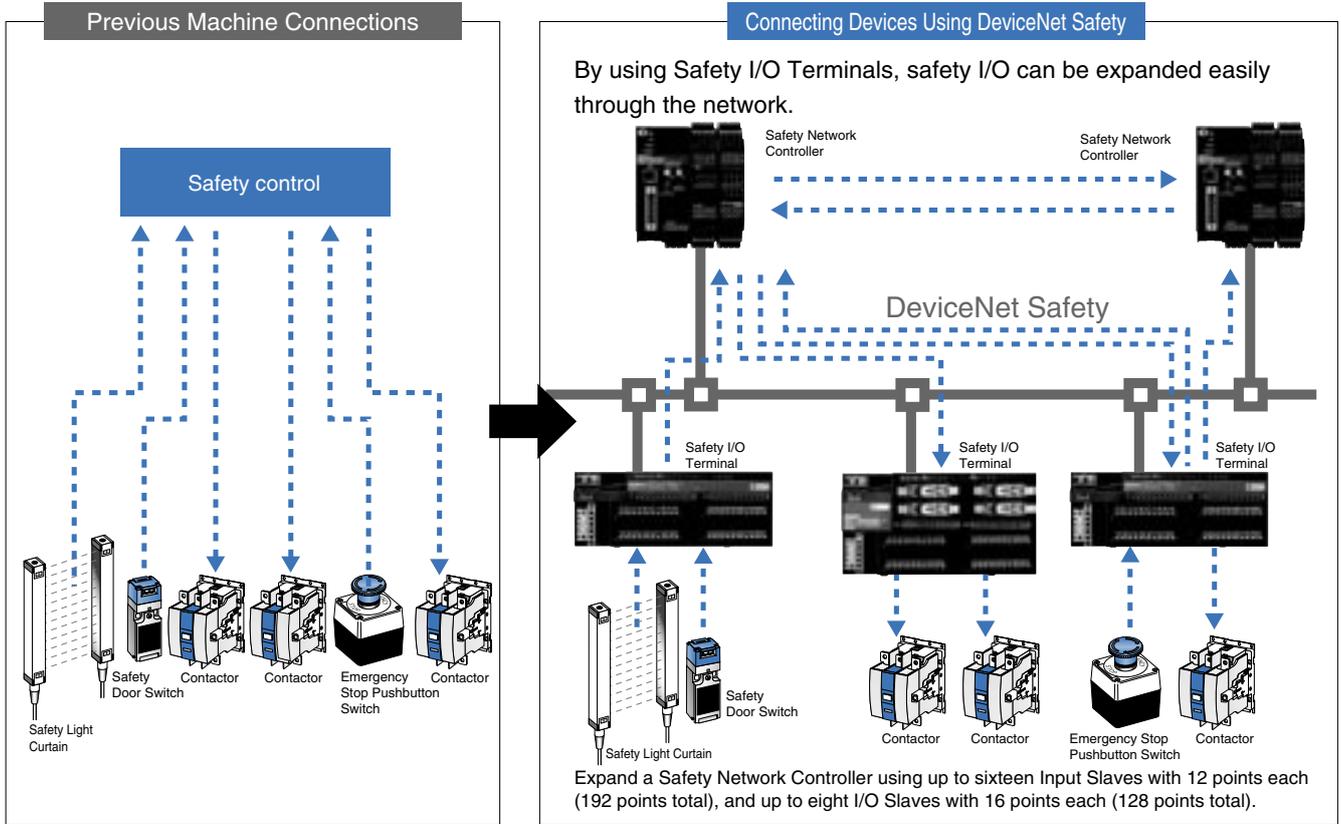
Delivers high-speed I/O response in a single Unit with up to 16 safety inputs and 8 safety outputs.



## Safety Network

### Expand Safety I/O Through Networks

Safety components distributed over many different installation locations required long and complicated wiring. Replacing the wiring with a network between safety components greatly improves productivity

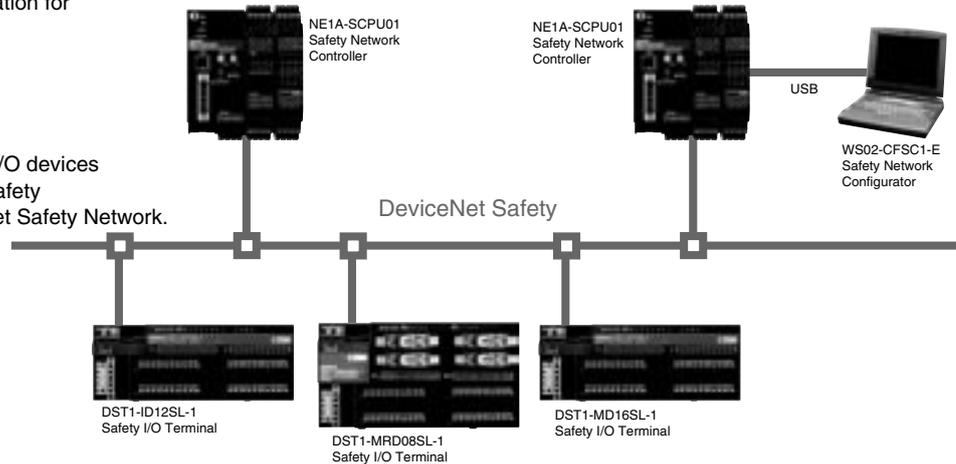


### System Configuration 2

Example of Safety I/O Configuration for Distributed Hazard Sources

- NE1A-SCPU01
- DST1 Series
- WS02-CFSC1-E

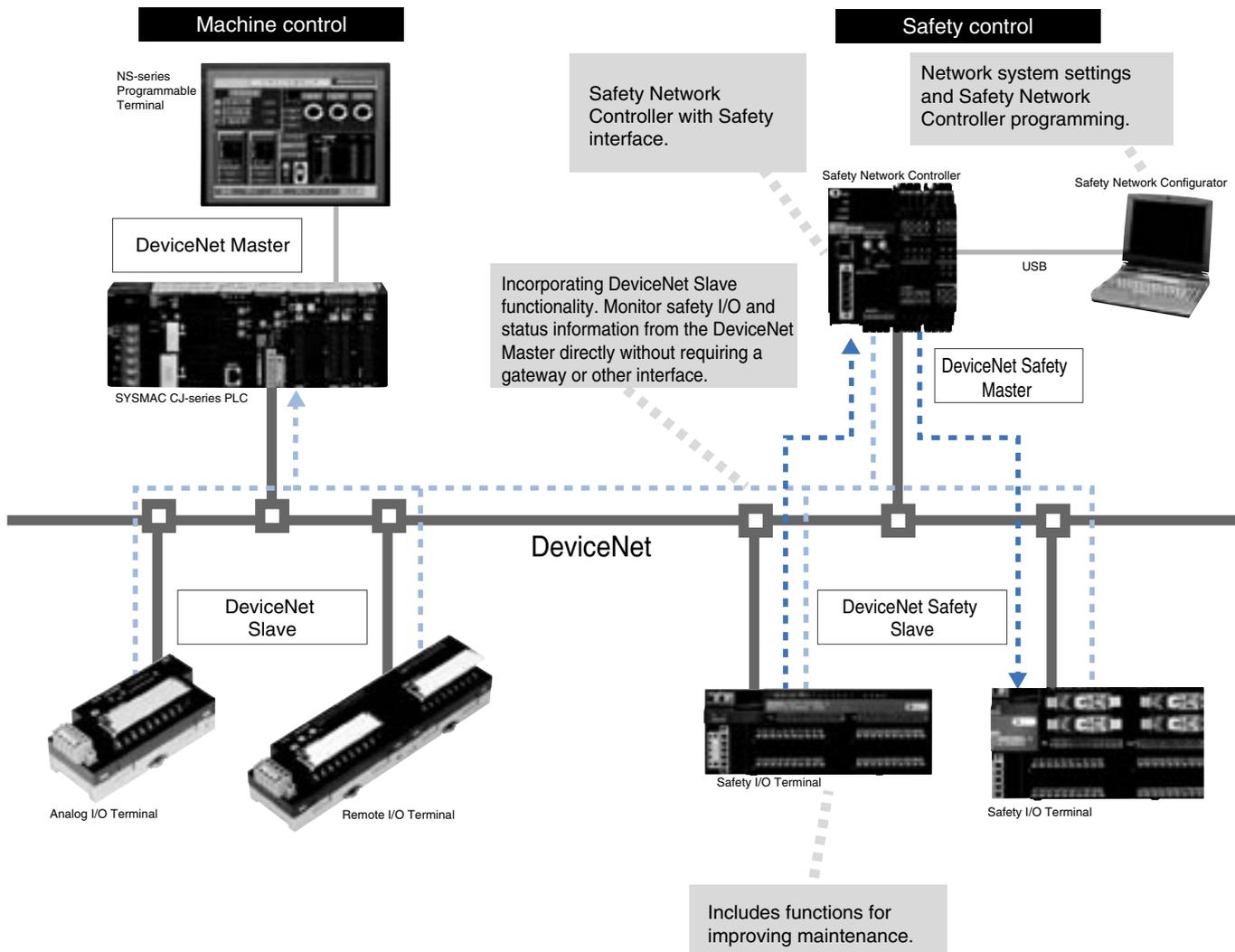
Distributed allocation of safety I/O devices can be achieved easily using Safety I/O Terminals and the DeviceNet Safety Network.



## Combined Safety / DeviceNet Network

### Compatible with the DeviceNet Open Network

Linking machine control is indispensable for achieving total control. By linking to machine control data, safety control can be monitored from the PLC, enabling the location of an error to be identified in an instant and improving maintenance. DeviceNet Safety System utilizes the DeviceNet wiring from the existing network as is.

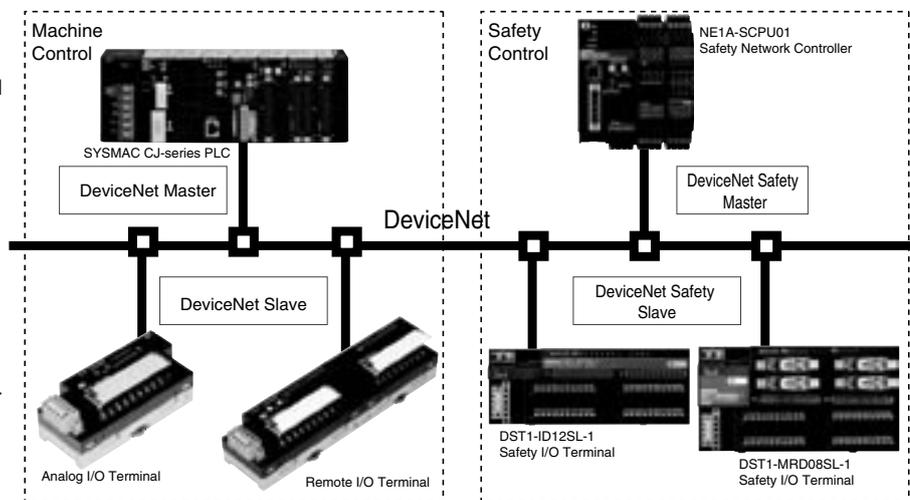


### System Configuration 3

System Configuration Example for Total Control of Machine Control and Safety Control

- SYSMAC CJ Series
- NE1A-SCPU01
- DST1 Series
- WS02-CFSC1-E

The DeviceNet Network can be used to monitor the status of safety I/O and safety circuits on the DeviceNet Safety Network from existing DeviceNet Masters or other PLCs.



Ordering Information

Safety I/O Terminals

Appearance	Appearance Description	Part Number
<p>Safety Network Controller</p> 	<p>16 PNP Inputs 8 PNP Outputs 4 Test Outputs 128 Function Block Programming Removable Cage Clamp Terminals</p>	<p>NE1A-SCPU01</p>

IP20 Safety I/O Terminals

Appearance	Appearance Description	Part Number
<p>Input Terminal</p> 	<p>12 PNP Inputs 4 Test Outputs Removable Cage Clamp Terminals</p>	<p>DST1-ID12SL-1</p>
<p>Mixed I/O Terminal</p> 	<p>8 PNP Inputs 8 PNP Outputs 4 Test Outputs Removable Cage Clamp Terminals</p>	<p>DST1-MD16SL-1</p>
<p>Mixed I/O Terminal</p> 	<p>4 PNP Inputs 4 relay Outputs (4 x 2-single pole) 4 Test Outputs Removable Cage Clamp Terminals</p>	<p>DST1-MRD08SL-1</p>

Software

Appearance	Appearance Description	Part Number
<p>Safety Network Configurator</p> 	<p>Installation Disk (CD-ROM) IBM PC/AT Compatible Windows 2000 or XP</p>	<p>WS02-CFSC1-E (English Version)</p>

## Specifications

### NE1A-SCPU01

#### General Specifications

DeviceNet communications power supply voltage	11 to 25 VDC (supplied from communications connector)	
Unit power supply voltage	20.4 to 26.4 VDC (24 VDC 15% +10%)	
I/O power supply voltage		
Consumption current	Communications power supply	24 VDC, 15 mA
	Internal circuit power supply	24 VDC, 230 mA
Overvoltage category	II	
Noise immunity	Conforms to IEC 61131-2	
Vibration resistance	10 to 57 Hz: 0.35 mm, 57 to 150 Hz: 50 m/s <sup>2</sup>	
Shock resistance	150 m/s <sup>2</sup> : 11 ms	
Mounting method	35-mm DIN Track	
Ambient operating temperature	10 to 55°C	
Ambient operating humidity	10% to 95% (with no condensation)	
Ambient storage temperature	40 to 70°C	
Degree of protection	IP20	
Weight	460 g max.	

#### Safety Input Specifications

Input type	Sinking inputs (PNP)
ON voltage	11 VDC min. between each input terminal and G1
OFF voltage	5 VDC min. between each input terminal and G1
OFF current	1 mA max.
Input current	4.5 mA

### DST1-□SL-1

#### General Specifications

DeviceNet communications power supply voltage	11 to 25 VDC (supplied from communications connector)	
Unit power supply voltage	20.4 to 26.4 VDC (24 VDC 15% +10%)	
I/O power supply voltage		
Consumption current	Communications power supply	DST1-ID12SL-1/MD16SL-1: 100 mA DST1-MRD08SL-1: 110 mA
Overvoltage category	II	
Noise immunity	Conforms to IEC 61131-2	
Vibration resistance	10 to 57 Hz: 0.35 mm, 57 to 150 Hz: 50 m/s <sup>2</sup>	
Shock resistance	DST1-ID12SL-1/MD16SL-1: 150 m/s <sup>2</sup> 11 ms DST1-MRD08SL-1: 100 m/s <sup>2</sup> 11 ms	
Mounting method	35-mm DIN Track	
Ambient operating temperature	10 to 55°C	
Ambient operating humidity	10% to 95% (with no condensation) DST1-MRD08SL-1: 10% to 85% (with no condensation)	
Ambient storage temperature	40 to 70°C	
Degree of protection	IP20	
Weight	DST1-ID12SL-1/MD16SL-1: 420 g DST1-MRD08SL-1: 600 g	

#### Safety Input Specifications

Input type	Sinking inputs (PNP)
ON voltage	11 VDC min. between each input terminal and G1
OFF voltage	5 VDC min. between each input terminal and G1
OFF current	1 mA max.
Input current	6 mA

Note: For details on operating precautions and other information required to use the product, be sure to read the following operation manual: DeviceNet Safety DST1-series Safety I/O Terminals Operation Manual (Z904)

#### Safety Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.5 A max. per output
Residual voltage	1.2 V max. between each output terminal and V2
Leakage current	0.1 mA max.

#### Test Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.7 A max. per output (See note.)
Residual voltage	1.2 V max. between each output terminal and V1
Leakage current	0.1 mA max.

Note: Total simultaneous ON current: 1.4 A

#### Standards

Certifying body	Standards
TÜV Rheinland	EN954-1:1996, EN60204-1:1997, EN61000-6-2:2001, EN61000-6-4:2001, EN418:1992, IEC61508 part1-7/12.98-05.00, IEC61131-2/02.03, NFPA 79-2002, ANSI RIA15.06-1999, ANSI B11.19-2003
UL	UL1998 (pending), NFPA79 (pending), UL508, CSA22.2 No14, UL1604

Note: For details on operating precautions and other information required to use the product, be sure to read the following operation manual: DeviceNet Safety Network Controller Operation Manual (Z906)

#### Safety Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.5 A max. per output
Residual voltage	1.2 V max. between each output terminal and V2
Leakage current	0.1 mA max.

#### Test Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.7 A max. per point
Residual voltage	1.2 V max. between each output terminal and V1
Leakage current	0.1 mA max.

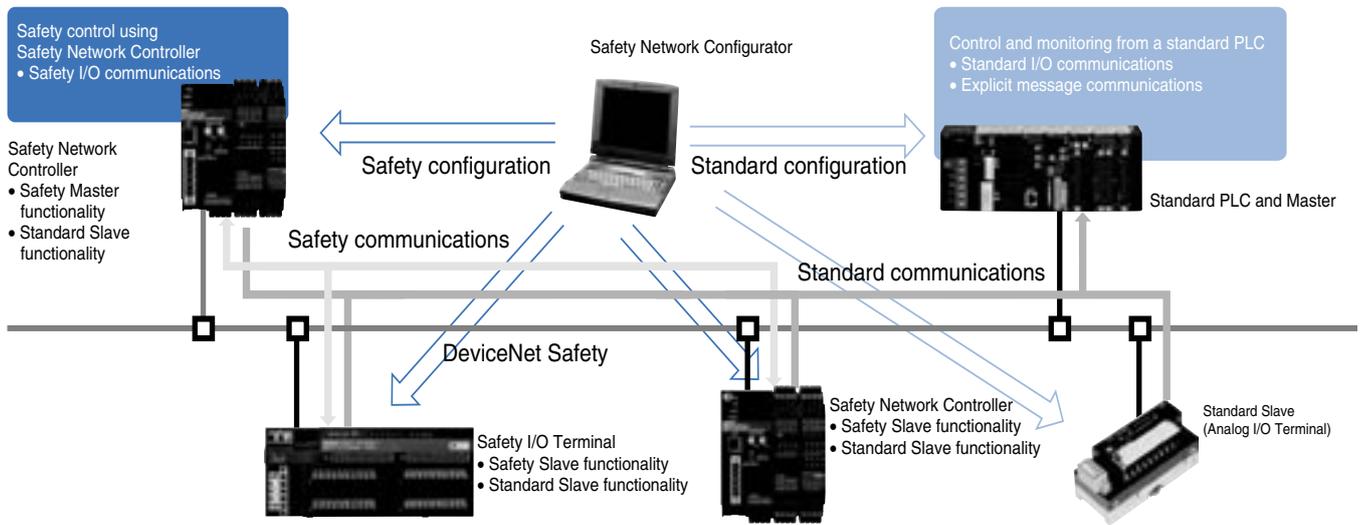
#### Safety Output Specifications for Relay Outputs

Relays	G7SA-2A2B, EN 50205 Class A
Minimum applicable load	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 =0.3), 1 A at 24 VDC
Mechanical life expectancy	5,000,000 operations min. (switching frequency of 7,200 operations/h)
Electrical life expectancy	100,000 operations min. (at rated load and switching frequency of 1,800 operations/h)

#### Standards

Certifying body	Standards
TÜV Rheinland	EN954-1/12.96, EN60204-1/12.97, EN61000-6-2/10.01, EN61000-6-4/10.01, EN418/1992, IEC61508 part1-7/12.98-05.00, IEC61131-2/02.03, NFPA 79-2002, ANSI RIA15.06-1999, ANSI B11.19-2003
UL	UL1998, NFPA79, UL508, CSA22.2 No14, UL1604 (DST1-ID12SL-1 and DST1-MD16SL-1 only)

WS02-CFSC1-E  
System Configuration



General Specifications

Compatible computer	IBM PC/AT or compatible
CPU	Pentium 300 MHz min.
OS	Windows 2000 or XP
Supported languages	English
Memory	128 Mbytes min.
Hard disk	40 Mbytes min. available space
Monitor	Display functionality of S-VGA monitor or higher
CD-ROM	One CD-ROM drive min.
Communications port	Either of the following communications ports is required. <ul style="list-style-type: none"> <li>• USB port: For online communications via SNC USB port (USB1.1)</li> <li>• DeviceNet Interface Card (3G8E2-DRM21-EV1): For online communications via DeviceNet.</li> </ul>

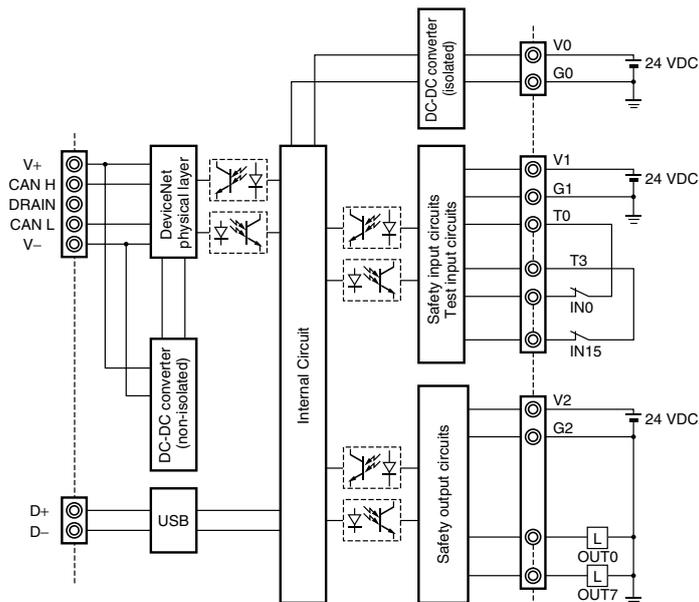
Manuals

Description	Reference Number
Devicenet Safety Network Controller Operation Manual	Z906
Devicenet Safety DST1-series Safety I/O Terminals Operation Manual	Z904
Devicenet Safety System Configuration Manual	Z905

Note: Windows is a registered trademark of Microsoft.  
 IBM is a registered trademark of International Business Machines Corp.

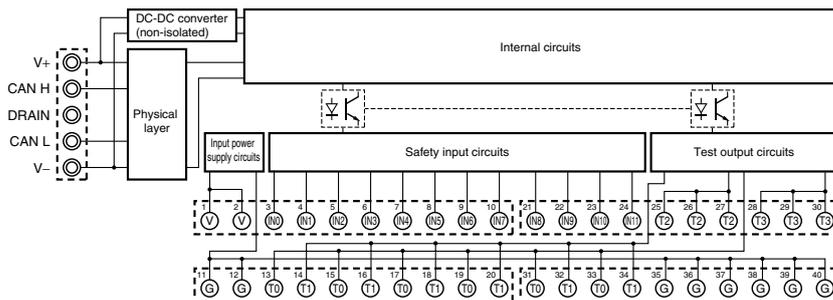
# Internal Circuit Configuration

NE1A-SCPU01

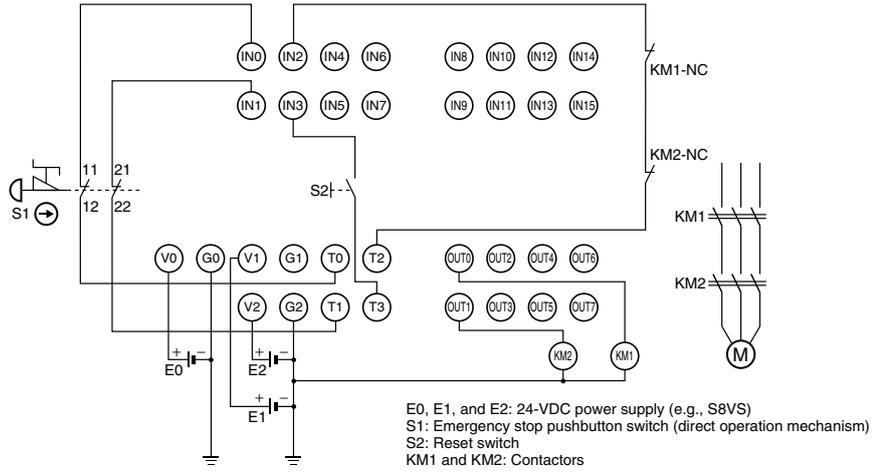


## Safety I/O Terminals

DST1-ID12SL-1

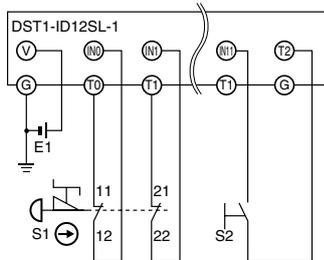


Emergency Stop Applications (Manual Reset)



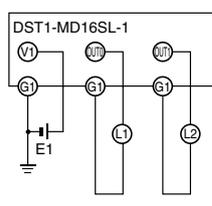
Safety I/O Terminals

● Emergency Stop Switch and Reset



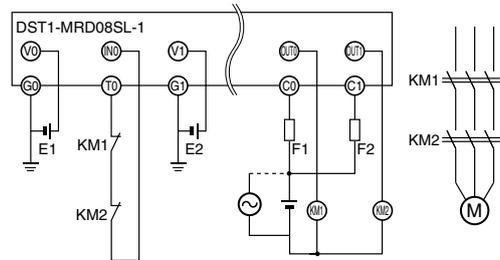
E1: 24-VDC Power Supply (e.g., S8VS)  
S1: Emergency stop pushbutton switch (direct operation mechanism)  
S2: Reset switch

● Safety Outputs



E1: 24-VDC Power Supply (e.g., S8VS)  
L1 and L2: Loads

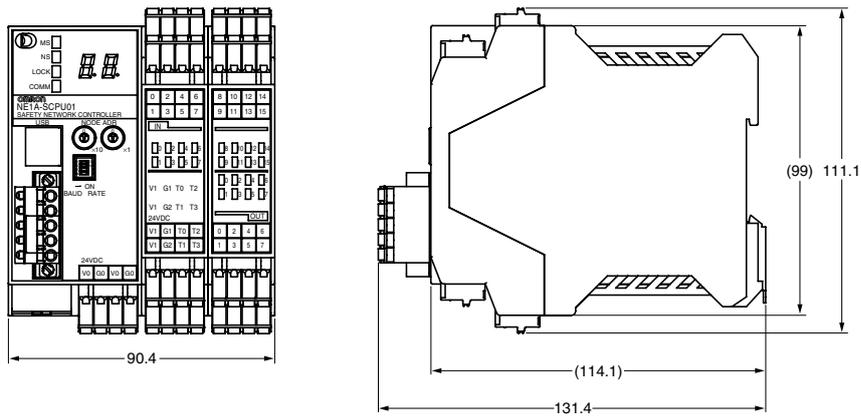
● Safety Output and Output Feedback



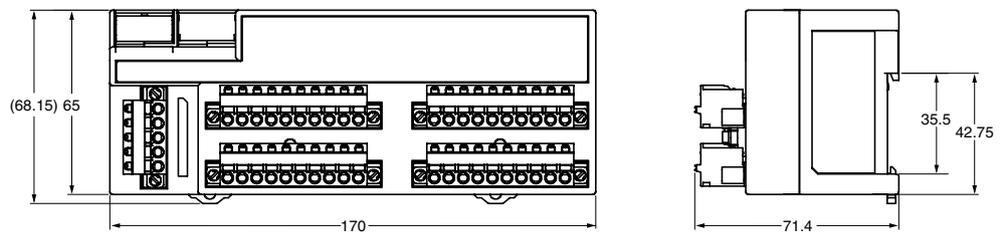
E1: 24-VDC Power Supply (e.g., S8VS)  
KM1 and KM2: Contactors  
F1 and F2: Fuses

Dimensions

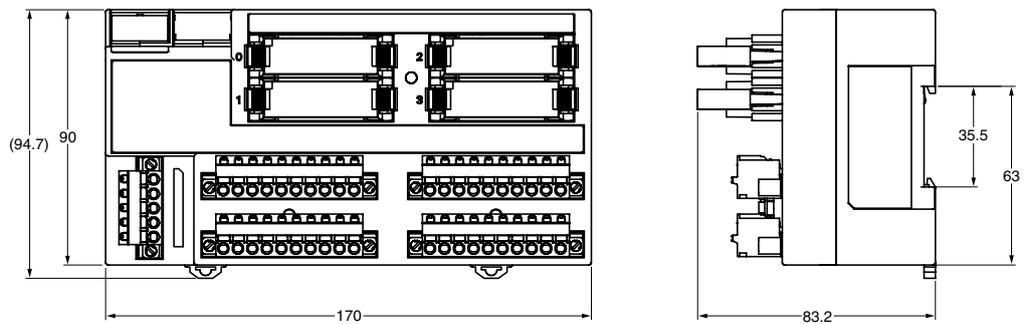
NE1A-SCPU01



DST1-ID12SL-1  
DST1-MD16SL-1



DST1-MRD08SL-1



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