

INSTRUCTION SHEET

Safety Controller

SafetyOne

FS1A-C11S

Confirm that the delivered product is what you have ordered. Read this instruction sheet to make sure of correct operation. Make sure that the instruction sheet is kept by the end user.

SAFETY NOTE

In this operation instruction sheet, safety precautions are categorized in order of importance Warning and Caution :

WARNING

Warning notices are used to emphasize that improper operation may cause severe personal injury or death.

CAUTION

Caution notices are used where inattention might cause personal injury or damage to equipment.

WARNING

- Do not disassemble, repair, or modify SafetyOne. This will cause impairment of the safe operability of SafetyOne.
- Turn off the power to SafetyOne before starting installation, removing, wiring, maintenance, or inspection of SafetyOne. This can cause electrical shocks or fire hazard.
- Before operating SafetyOne, carefully read this instruction sheet and the latest user's manual (FS9Z-B1218), and ensure that the environment conforms to the requirements of SafetyOne specifications. If SafetyOne is operated in an environment that exceeds the specifications of SafetyOne, it causes impairment of the safe operation of SafetyOne.
- The installation, wiring, configuration, and operation of SafetyOne must be performed only by "Safety responsible persons". Safety responsible persons are personal who have requisite qualification authorizing them as being capable of safely carrying out each step including the designing, installation, operation, maintenance, and disposal of SafetyOne. Persons without this technical expertise must not use SafetyOne.
- SafetyOne must be subjected to regular proof test verification that each function of SafetyOne is performing up to the required standard.
- Installation of SafetyOne must be performed according to the instructions found in this instruction sheet and the user's manual. Improper installation may cause the SafetyOne to fail.
- Do not use the monitor outputs or solenoid/lamp outputs as safety outputs. When there is a failure in SafetyOne or peripheral devices, impairment of the safe operation of the system is possible.
- The start switch has to be placed outside the danger zone and in a safe position from which there is good visibility for checking that no person is within the danger zone.
- Do not use the start input and the external device monitor input as a safety input. When there is a failure in SafetyOne or peripheral devices, impairment of the safe operation of the system is possible.
- Use the SafetyOne in compliance with laws and regulations of the country in which it is being used.
- Use safety inputs and safety outputs in circuit configurations conforming to the application according to the usage, and the safety requirements.
- Calculate respective safety distances, taking into consideration the response time of the SafetyOne, safety devices to be connected to the SafetyOne, and each other devices that forms a part of the system configuration.
- Applicable safety performance is dependent on each system configuration.
- Use a power supply that meets following required specifications :
 - Conforms to the power supply rating of SafetyOne.
 - Complies with the SELV/ PELV circuit specified by EN 50178 or EN60950.
 - Has the functionality or the functional equivalent of the control voltage and current of class 2 circuit, as defined in UL508 or UL1310.
 - Is in compliance with safety laws and regulations relating to electrical safety, EMC, and like under the laws and regulations of the country in which it is being used.
- Ground the V- line (0V DC) for ground fault diagnosis.
- In the case of a new configuration or modified configuration, be sure to perform a check for each input and output function.
- Implement protective measures that personal, other than safety responsible persons operating the SafetyOne, are unable to modify the configuration.
- Separate SafetyOne from devices and wires which are not according to class 2 circuit requirements.

CAUTION

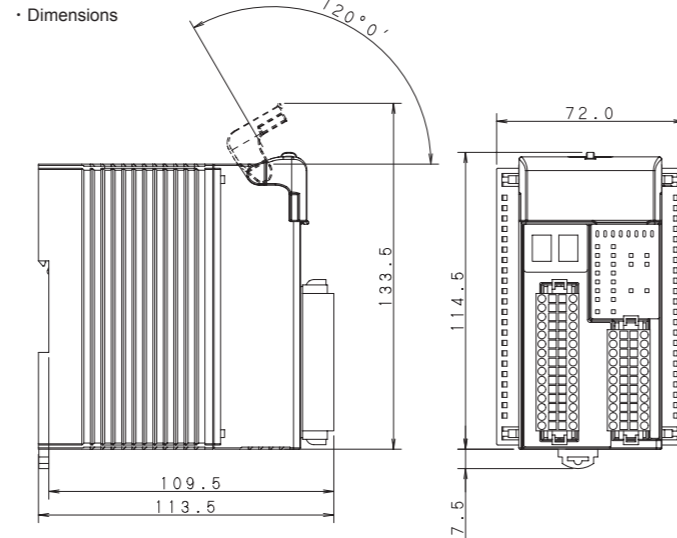
- SafetyOne is designed for installation within an enclosure. Do not install SafetyOne outside an enclosure. Install SafetyOne in enclosure rated IP54 or higher.
- Install SafetyOne in environments described in the catalog, instruction sheet, and user's manual. If SafetyOne is used in places where the SafetyOne is subjected to high temperature, high humidity, condensation, corrosive gases, excessive vibrations, and excessive shocks then electrical shocks, fire hazard, or malfunction may result.
- Environment for using the SafetyOne is "Pollution degree 2". Use SafetyOne in environments of pollution degree 2 (according to IEC/EN60554-1).
- Prevent SafetyOne from falling while moving or transporting the SafetyOne, otherwise damage or malfunction of the SafetyOne may result.
- Prevent metal fragments and pieces of wire from dropping inside the SafetyOne housing. Ingress of such fragments and chips may cause fire hazard, damage or malfunction.
- Install SafetyOne, so that there is adequate distance from the walls, heat generating bodies, and peripherals, taking into consideration space requirements for maintenance and ventilation.
- Install SafetyOne on 35mm DIN rails with BNL6 mounting clips (sold separately) on both sides of SafetyOne.
- Wire the connectors with conforming cables or ferrules.
- Ground FE terminal to assure electromagnetic compatibility.
- Use common 0V DC, if different power supplies are used for SafetyOne and other devices (ex. safety light curtain).
- Wire the inputs and outputs so that they are separated from power lines.
- When overcurrent flows into output terminals, the protective function turns off the output. However, when overcurrent status lasts long, internal protective elements will fuse. To protect the internal elements, insert fuses of double the rated value to each terminal.
- Use IEC60127 approved fuses on outside of the power line. (This is required for equipment incorporating SafetyOne that is destined for Europe.)
- When disposing of SafetyOne, handle it under the laws and regulations of the country in which it is disposed.

1 Unpacking

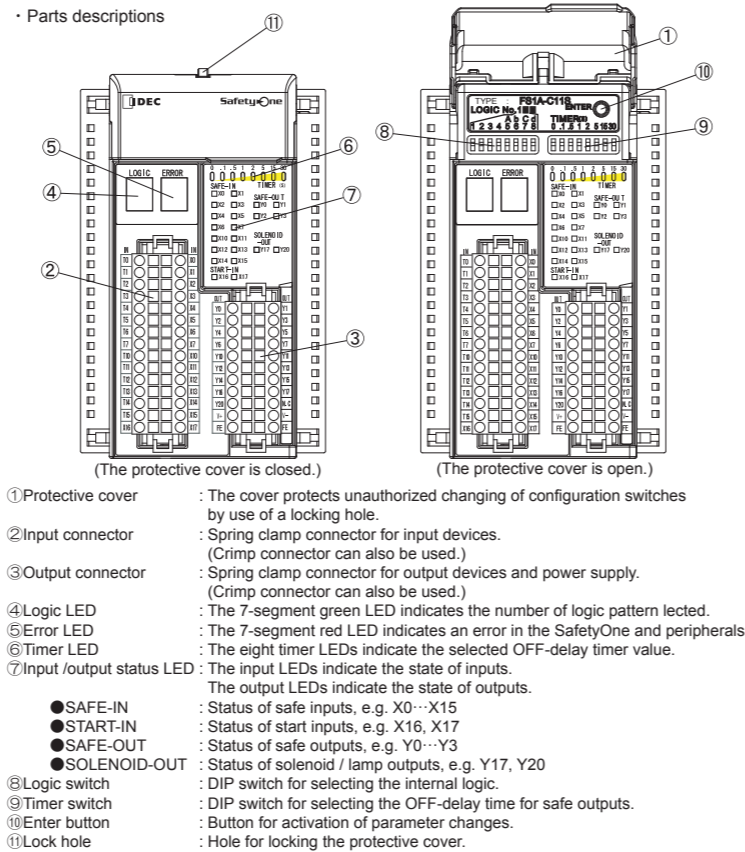
- Before installing the FS1A-C11S, make sure that following items are contained completely without damage during transportation.

| Item | Type Number | Number |
|--|-----------------------|------------|
| Module | FS1A-C11S | 1 |
| Connector (input / output) | FS9Z-CN01 / FS9Z-CN02 | 1 for each |
| Configuration tool | | 1 |
| Marking tie | FS9Z-MT01 | 3 |
| Instruction sheet (English / Japanese) | B-1216 / B-1217 | 1 for each |

2 Dimensions and Parts Descriptions



Parts descriptions



3 Product Specifications

| General specifications | |
|---|--|
| Operating temperature (Surrounding air temperature) | -10 to +55°C (no freezing) |
| Relative operating humidity | 10 to 95% (non-condensing) |
| Storage temperature | -40 to +70°C (no freezing) |
| Relative storage humidity | 10 to 95% (non-condensing) |
| Pollution degree | 2 (IEC/EN60664-1) |
| Degree of protection | IP20 (IEC/EN60529) |
| Corrosion immunity | Atmosphere be free from corrosive gas |
| Altitude | Operation : 0 to 2000m (0 to 6565 feet) Transportation : 0 to 3000m (0 to 9840 feet) |
| Vibration resistance | Vibration : 5 to 8.4Hz amplitude 3.5mm, 8.4 to 150Hz acceleration 9.8m/s ² (1G) 2 hours per each of XYZ axes (IEC/EN60068-2-6) Bump : Acceleration 98m/s ² (10G) 16ms duration 1000 times per each of XYZ axes (IEC/EN60068-2-29) |
| Shock resistance | 147m/s ² (15G), 11ms duration, 3 times per each of XYZ axes (IEC/EN60068-2-27) |
| Connector durability | 50 times maximum |
| Operation strength of configuration switches | 100 operations maximum (per 1 switch) |
| Operation strength of enter button | 1000 operations maximum |
| Enclosure material | Modified-Poly Phenylene Ether (m-PPE) |
| Weight | Approx. 330g |
| Life time | 10 years (at 40°C of operating temperature) |
| Over voltage category | II |

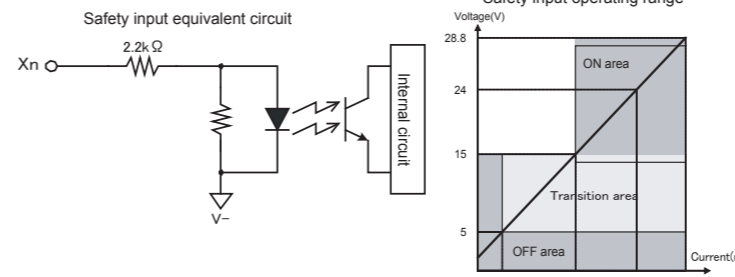
| Electrical conditions | |
|--|---|
| Rated voltage | 24V DC |
| Allowable voltage range | 20.4V DC to 28.8V DC |
| Power consumption | 48W (at rated voltage, all inputs and outputs are ON, includes output loads) |
| Allowable momentary power interruption | 10ms minimum (at rated voltage) |
| Reaction time | ON to OFF : 40ms maximum ^{Note1} / 100ms maximum ^{Note2} OFF to ON : 100ms maximum ^{Note3} |
| Start-up time ^{Note4} | 6s maximum |
| Dielectric strength | Between live part and FE terminal : 500V AC 1minute Between enclosure and FE terminal : 500V AC 1minute |
| Insulation resistance | Between live part and FE terminal : 10MΩ minimum (at 500V DC megger) Between enclosure and FE terminal : 10MΩ minimum (at 500V DC megger) |
| Noise immunity (Noise simulator) | DC power terminals : 1.0kV 50ns to 1μs I/O terminals : 2.0kV 50ns to 1μs (with coupling adapter) |
| Inrush current | 25A maximum |
| Affect of improper power supply connection | Reverse polarity : No operation, no damage Improper voltage : Permanent damage may occur |
| Applicable standards | IEC 61508 part1-7, EN ISO13849-1, IEC/EN 62061, IEC/EN 61131-2, IEC/EN 61000-6-2, IEC/EN 61000-6-4, IEC/EN 61326-3-1, IEC/EN 61496-1, ISO 13851, UL 508, CSA C22.2 No.142 |

- Note1 : Time to shut OFF safety outputs after inputs are turned OFF or input monitor error is detected (in case of OFF-delay timer is 0s).
 Note2 : Time to shut OFF safety outputs after error is detected (in case of OFF-delay timer is 0s).
 Note3 : Time to turn ON safety outputs after safe inputs are turned ON (in case of auto start).
 Note4 : Time to change to Run state after power supply is turned ON.

Safety input specifications

| Drive terminal specifications (T0, T1, T2, T3, T4, T5, T6, T7, T10, T11, T12, T13, T14, T15) | |
|--|--|
| Rated drive voltage | Power supply voltage |
| Minimum drive voltage | Power supply voltage -2.0V |
| Number of drive terminals | 14 |
| Maximum drive current | 20mA per port (at 28.8V DC) ^{Note1} |
| Receive terminal specifications (X0, X1, X2, X3, X4, X5, X6, X7, X10, X11, X12, X13, X14, X15) | |
| Rated input voltage | 24V DC |
| Input ON voltage | 15.0V DC to 28.8V DC |
| Input OFF voltage | Open or 0V DC to 5.0V DC |
| Number of receive terminals | 14 |
| Rated input current | 10 mA per port (at rated voltage) |
| Input type | Sink type input (PNP input), Type1 (IEC/EN61131-2) |
| Wiring specifications | |
| Cable length ^{Note2} | 100m maximum (total wiring length per 1 input) |
| Allowable wiring resistance | 300Ω maximum |

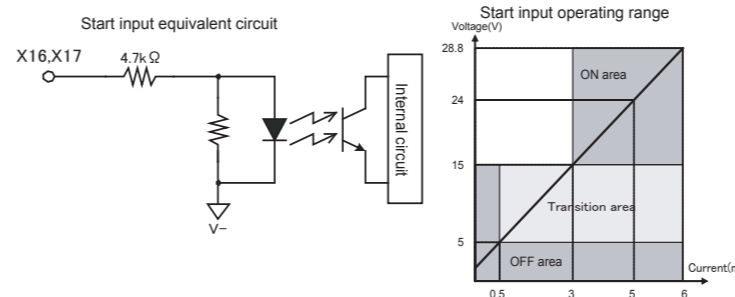
- Note1 : The drive port generates check pulses in order to diagnose input devices and internal circuits. (Wiring and the diagnostic function are different depending on the logic selected. See further information in user's manual "Chapter 5 LOGIC". The basic specifications are the same.)
 Note2 : For cables longer than 30m between SafetyOne and connected devices, or wiring drive terminals and receive terminals separately, use grounded shielded cables to assure electromagnetic immunity.



Start input specifications

| | |
|---------------------------------|--|
| Rated input voltage | 24V DC |
| Input ON voltage | 15.0V DC to 28.8V DC |
| Input OFF voltage | Open or 0V DC to 5.0V DC |
| Number of start input terminals | 2 (X16, X17) |
| Input current | 5mA per terminal (at rated voltage) |
| Type of input | Sink type input (PNP input), Type1 (IEC/EN61131-2) |
| Cable length ^{Note1} | 100m maximum (total wiring length per 1 input) |
| Allowable wiring resistance | 300Ω maximum |

- Note1 : For cables longer than 30m between SafetyOne and connected devices, use grounded shielded cables to assure electromagnetic immunity.

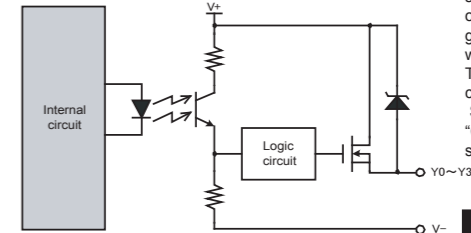


Safety output specifications

| | |
|---|---|
| Output type | Source output (N channel MOSFET) |
| Rated output voltage | Power supply voltage |
| Minimum output voltage | Power supply voltage -2.0V |
| Number of output terminals | 4 (Y0, Y1, Y2, Y3) |
| Maximum output current | Point : 500mA maximum Total : 1A maximum |
| Leakage current | 0.1mA maximum |
| Allowable inductive load ^{Note1} | L/R = 25ms |
| Allowable capacitive load | 1μF maximum |
| Cable length ^{Note2} | 100m maximum (total wiring length per 1 output) |

- Note1 : For protection of output circuits, protection devices such as diodes should be connected to output circuits with inductive loads.
 Note2 : For cables longer than 30m between SafetyOne and connected devices, use grounded shielded cables to assure electromagnetic compatibility.

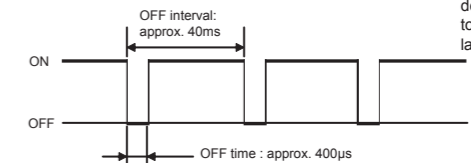
Safety output equivalent circuit



Safety outputs of the SafetyOne are semiconductor outputs. For diagnostics of the shut-off function, the SafetyOne generates off-pulses in certain intervals when the outputs are in ON state. The specifications of the safety outputs change depending on the logic selected. See further information in user's manual "Chapter 5 LOGIC". But the basic specifications are the same.

CAUTION

Check the response time of the external devices so they do not correspond to the off-pulses. Monitor and solenoid/lamp outputs do not generate OFF-pulses.

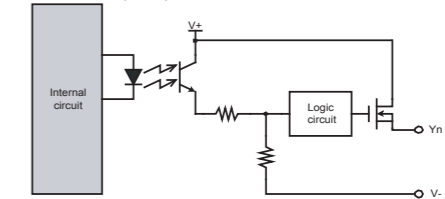


Monitor output specifications

| | |
|-------------------------------|--|
| Output type | Source output (N channel MOSFET) |
| Rated output voltage | Power supply voltage |
| Minimum output voltage | Power supply voltage -2.0V |
| Number of output terminals | 11 (Y4, Y5, Y6, Y7, Y10, Y11, Y12, Y13, Y14, Y15, Y16) |
| Maximum output current | Point : 20mA maximum Total : 220mA maximum |
| Leakage current | 0.1mA maximum |
| Cable length ^{Note1} | 100m maximum (total wiring length per 1 output) |

- Note1 : For cables longer than 30m between SafetyOne and connected devices, use grounded shielded cables to assure electromagnetic compatibility.

Monitor output equivalent circuit



The specifications of the monitor outputs change depending on the logic selected. See further information in user's manual "Chapter 5 LOGIC". The basic specifications are the same.

WARNING

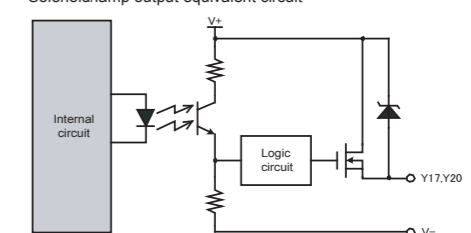
Do not use monitor outputs for safety related purposes. This may cause a loss of safety functions in case of failure of the SafetyOne or peripherals.

Solenoid/lamp output specifications

| | |
|---|---|
| Output type | Source output (N channel MOSFET) |
| Rated output voltage | Power supply voltage |
| Minimum output voltage | Power supply voltage -2.0V |
| Number of output terminals | 2 (Y17, Y20) |
| Maximum output current | Point : 500mA maximum Total : 500mA maximum |
| Leakage current | 0.1mA maximum |
| Allowable inductive load ^{Note1} | L/R = 25ms |
| Cable length ^{Note2} | 100m maximum (total wiring length per 1 output) |

- Note1 : For protection of output circuits, protection devices such as diodes should be connected to output circuits with inductive loads.
 Note2 : For cables longer than 30m between SafetyOne and connected devices, use grounded shielded cables to assure electromagnetic compatibility.

Solenoid/lamp output equivalent circuit



The specifications of the solenoid/lamp outputs change depending on the logic selected. See further information in user's manual "Chapter 5 LOGIC". But the basic specifications are the same.

WARNING

Do not use solenoid/lamp outputs for safety related purposes. This may cause a loss of safety functions in case of failure of the SafetyOne or peripherals.

