Three phase solid state contactor

ENG

• DATA MANAGEMENT • CONTROLS • PROCESS AUTOMATION•
COMMISSIONING FLOWCHART

1. Check characteristics
2. Wiring
3. Fan power supply
4. Apply control signal
5. Power on. Check firing
6. Alarms signalled
7. Normal operation
8. Adjust DLF alarm (if conditions met)
9. Characteristics correspond to product code and specifications
10. Supply protection, protective earth (PE)
11. For fan-cooled solid state contactors
12. DC logic signal: "LDC" terminal block
   AC logic signal: "HAC" terminal block
   4-20 mA analogue signal: "ATP" terminal block
13. ON, HEAT LEDs
14. GRF, DLF LEDs
15. CHK/SET push button
16. Chapter 1
17. Chapter 2
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20. Chapter 3
21. Chapter 2
22. Chapter 2
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</tr>
</tbody>
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### Eurotherm Limited

5-1

## PURPOSE OF MANUAL

This manual (Issue 3) describes the Basic Version and all Options for 7300S series solid state contactors with current ratings **up to 160 A**.
EUROPEAN DIRECTIVES AND APPLICABLE STANDARDS

COMPLIANCE WITH PRODUCT STANDARD

7300S products comply with the terms of product standard EN 60947-4-3 ‘Contactors and motor-starters - AC semiconductor controllers and contactors for non-motor loads’.

CE LABELLING

7300S products, installed and operated in accordance with their user manual, bear CE labelling on the basis of compliance with the essential requirements of :


SAFETY

The units have IP20 protection rating as defined by standard IEC 60529. External wiring must comply with standards IEC 60364-4-43 and IEC 60943. Copper cables and conductors must be used, rated to a temperature of 75°C (167°F).

ELECTROMAGNETIC COMPATIBILITY (EMC) TEST STANDARDS

7300S products installed and used in accordance with the user manual, are designed for an industrial environment and not a commercial or light industrial premises and must not be used in the home.

IMMUNITY

The EMC immunity test standards required by product standard EN 60947-4-3 are given in the table following :

<table>
<thead>
<tr>
<th>Test type</th>
<th>Minimum level</th>
<th>EMC test standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic discharge</td>
<td>4 kV on contact; 8 kV in air</td>
<td>EN 61000-4-2</td>
</tr>
<tr>
<td>Radiated, radio frequency electromagnetic field</td>
<td>10 V/m 80 MHz ≤ f ≤ 1 GHz; 80% modulation 1 kHz sinusoid</td>
<td>EN 61000-4-3</td>
</tr>
<tr>
<td>Electrical fast transient / burst</td>
<td>2 kV / 5 kHz</td>
<td>EN 61000-4-4</td>
</tr>
<tr>
<td>Electrical Surge</td>
<td>4 kV line to earth</td>
<td>EN 61000-4-5</td>
</tr>
<tr>
<td>Conducted disturbances</td>
<td>140 dBμV; 150 kHz ≤ f ≤ 80 MHz</td>
<td>EN 61000-4-6</td>
</tr>
<tr>
<td>Voltage dips and short interruptions</td>
<td>5 s interruptions</td>
<td>EN 61000-4-11</td>
</tr>
</tbody>
</table>

Table 1     EMC immunity standards compliance
EMISSIONS
The EMC emissions test standards required by product standard EN 60947-4-3 are given in the table following:

<table>
<thead>
<tr>
<th>Emission type</th>
<th>Firing mode</th>
<th>EMC test standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiated at radio frequencies</td>
<td>All firing modes</td>
<td>CISPR 11 Class A</td>
</tr>
<tr>
<td>Conducted at radio frequencies</td>
<td>All firing modes</td>
<td>CISPR 11 Class A Group 2</td>
</tr>
</tbody>
</table>

Table 2  EMC emissions standards compliance

EMC GUIDE
To help you deal with installation-dependent electromagnetic interference effects, Eurotherm provides an ‘Electromagnetic compatibility’ installation guide (ref. HA 025464) which sets out best current practice regarding EMC.

DECLARATION OF CONFORMITY
A CE declaration of conformity is available on request.
Chapter 1

1. IDENTIFICATION OF SOLID STATE CONTACTOR UNITS

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1. Chapter 1 IDENTIFICATION

1.1 GENERAL PRESENTATION

7300S series solid state contactors control the electrical power to three-phase industrial loads such as low temperature coefficient and short wave infrared elements. Standard ratings in the series range from 16 A to 160 A, at voltages from 200 V to 500 V. 7300S series solid state contactors comprise three channels, controlled by thyristors. Depending on the type of control signal and the type of input specified, 2 operating modes are available: logic (‘on/off’) or modulation (‘Burst mode’).
Identifying information:

- **Identification**
  - **GRF**
  - **DLF CHK**
  - **ON HEAT SET**
  - **7300SEUROTHERM**
  - **P E3 / L 2**
  - **4 / T 22 / T 1**
  - **1 / L 1**
  - **ε**
  - **5 / L 3**
  - **6 / T 3**
  - **63 A / 500 V**
  - **EN 60947-4-3**
  - **Aux1 230 N**
  - **16 17 18**
  - **Aux2 GND 24V 0VS**
  - **15 19 20**
  - **Protective earth terminal**
  - **Power terminals**
  - **(supply)**
  - **(load)**
  - **Internal power wiring diagram**
  - **Serious Alarm**
    - (if DLF option)
  - **Diagnostic Alarm**
    - (if DLF option)
  - **Electronics supply**
  - **Zero crossing firing mode:**
    - Firing request LED
  - **Control terminal pinouts**
  - **Control connector**

---

**Figure 1-2 General view of 7300S with analogue control - ratings from 63 A to 100 A**
Figure 1-3 General view of 7300S with analogue control - ratings ≥ 125 A
1.2. TECHNICAL SPECIFICATIONS

1.2.1. USE

In accordance with product standard EN 60947-4-3:
Units for uninterrupted service:
1. Semiconductor contactor (DOL) variant 5:
   logic input signal: DC (LDC input) or AC (HAC input).
2. Thyristor unit variant 4:
   4-20 mA analogue input signal: ATP input or digital communication option.
Configuration on order.

1.2.2. POWER

Nominal current per phase 16 A to 160 A (defined at 45°C) depending on product code
The unit can be used up to 60°C ambient temperature, following derating curves. Please consult Eurotherm.
Nominal line to line voltage 200 V to 500 V depending on product code (+10% and -15%).
Frequency Use from 47 to 63 Hz (automatic matching)
Dissipated power Approx: 1.3 W (typical) - 2 W max per amp and per phase (with fuses).
Cooling Ratings ≤ 100 A: natural convection
Ratings ≥ 125 A: fan (115 V or 230 V external supply), consumption 10 VA.

1.2.3. LOAD

Three-phase Industrial Load.
The categories of use applicable for each unit are indicated on the identification label
• AC-51 Non-inductive or low inductance loads, furnace resistances
  (Resistive load with low temperature coefficient).
• AC-55b Switching of incandescent lamps, short wave infrared elements (SWIR), for ≤ 100 A units.
Connections Independent of order of phase rotation
Load configuration
• Star with neutral (4 wires)
• Star without neutral (3 wires)
• Closed delta (3 wires)
• Open delta (6 wires).

1.2.4. SIGNALLING

Basic version
Supply present Green ‘ON’ LED.
Thyristor firing request Green ‘HEAT’ LED.
With options
Alarms Red and orange LEDs, alarm relay contact.
1.2.5. FIRING MODES

Thyristor switching: At thyristor zero voltage crossing.

‘Logic’ mode: DC signal applied to LDC input (Low Direct Current).
AC signal applied to HAC input (High Alternating Current).

‘Burst’ mode: Supply voltage modulated by the 4-20 mA analogue signal applied to the ATP input (Analogue to Time Proportional).
Firing base time: 0.3 s (approx. 15 cycles at 50 Hz).

• with ‘Digital Communication’ option
  base modulation time: from 1 cycle (‘Single-cycle’ mode)
  (or 1 half-cycle in ‘Advanced single-cycle’ mode)
  to 255 cycles.

1.2.6. INPUTS

Power Supply: Self-powered electronics.

‘Logic’ firing:
• DC signal: Conducting from 4.5 Vdc to 32 Vdc max, current ≥ 9 mA.
  (LDC input) Off < 1.5 V or < 0.1 mA. Response time ≤ 10 ms.
  If the unit has the DLF option, and that you want to drive it using a REMIO output or i7000, please contact the Eurotherm’s application services

• AC signal: Conducting from 85 to 253 Vac max. Impedance ≈ 7 kΩ at 50 Hz.
  (HAC input) Off < 10 Vac. Response time ≤ 60 ms.
  (If an RC snubber contact protection circuit or control optotriac is used, the maximum capacitor value is 22 nF for 240 Vac).

• With DLF option:
  • According to the control signal, one of the two following criteria must be respected:
    • $T_{conduction\ min} = T_{non-conduction\ min} \geq 0.3$ second
    • $T_{modulation} \geq 4$ seconds
  
  If DLF option is used with Short Wave Infrared loads (SWIR), the product is not UL approved.

‘Burst mode’ firing:
• Analogue signal: 4 - 20 mA (10 Vdc max).
  (ATP input) Modulation depending on signal.
  Firing base time: 0.4 s @ 50 % and 50 Hz.

• Digital communication:
  • Digital signals, Modbus® protocol

1.2.7. CONTROL - ATP input only

Control type: Open loop
Linearity and Stability: Better than ± 2% of full scale.
### 1.2.8. ALARMS (Options)

#### DLF option

**Serious alarms**
- Total load failure (TLF) and thyristor short circuit (THSC) detection.

**Signalling**
- When a serious alarm is detected:
  - the red ‘GRF’ LED is lit
  - the alarm relay contact is activated.

**Diagnostic alarm**
- Partial load failure detection and diagnosis.

**Signalling**
- If a partial load failure (PLF fault) is detected:
  - the orange ‘DLF’ LED is lit
  - the alarm relay contact is activated.

**Settings**
- The front panel push button is used for:
  - monitoring and diagnosis
  - adjusting and resetting the alarm.

**Sensitivity**
- Detects the failure of at least:
  - 1 element out of 4 in 3S, 4S, 6D configuration
  - 1 element out of 3 in 3D configuration

#### Over-temperature alarm

For all fan-cooled units (≥ 125 A), the unit cuts out if the temperature threshold is exceeded, whether or not options are fitted.

**Signalling**
- If an over-temperature alarm is detected:
  - the red ‘T°’ LED is lit
  - the alarm relay contact is activated provided one of the alarm options is selected.

#### Alarm relay

- Available with one of the Alarm options.
- The relay contact (0.25 A/230 Vac or 30 Vdc) is either open on alarm or closed on alarm depending on the product code.

### 1.2.9. PROTECTION

#### Short circuits

- **co-ordination type**: Type 1 (high-speed fuses).
- **Electrical protection**: IP20 without adding additional protection.
- **Thyristors**: Varistors and RC snubbers.

**High-speed fuses**:
- ratings ≤ 100 A: external (selected in product code)
- ratings ≥ 125 A: internal.

- No fuse for short wave infrared elements.

#### Replacement fuses

- See chapter 4.
1.2.10. ENVIRONMENT

Use
0 to 45°C at nominal current, at maximum altitude of 1000 m.

Storage
-10°C to 70°C.

Isolation voltage
Assigned isolation voltage $V_i = 500 \text{ V}_{\text{rms}}$

Pollution
Degree 2 acceptable (defined by IEC 60664).

Humidity
RH 5% to 95%, non-condensing, non-streaming.

Over-voltage
Over-voltage category II (as defined by IEC 60664) $V_{\text{imp}} = 4 \text{ kV}$.

1.2.11. DIMENSIONS

<table>
<thead>
<tr>
<th>Ratings</th>
<th>Height</th>
<th>Width</th>
<th>Depth (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Basic</td>
</tr>
<tr>
<td>16 A to 40 A</td>
<td>220 mm</td>
<td>96 mm</td>
<td>164</td>
</tr>
<tr>
<td>63 A to 100 A</td>
<td>305 mm</td>
<td>144 mm</td>
<td>295</td>
</tr>
<tr>
<td>125 A to 160 A</td>
<td>498 mm</td>
<td>144 mm</td>
<td>295</td>
</tr>
</tbody>
</table>

Table 1-1 Units dimensions according to the ratings and the options chosen

1.2.12. MOUNTING

Attachment
Attachment plate fixed to unit:
- on symmetrical EN50022 DIN rail or
- bulkhead mounting
  (for ratings ≥ 63 A: bulkhead mounting only).

1.2.13. DIGITAL COMMUNICATION

Availability
The digital communication option is exclusive with:
- control using the logic or analogue input signal.

Protocol
Modbus® RTU.

Compliance

Power supply
24 Vac (±20%), 47 to 63 Hz or
24 Vdc (±20%) non-polarised.
Typical consumption 1.5 VA
Protection: external 2 A fuse.
External wiring should comply with standard IEC 60364.

Transmission
Standard RS485, 2 wires.
Speed: 9600 or 19200 baud.
Selected by switch on front panel. The speed is factory set to correspond to the selected product code.
### Identification

| Termination | The communication bus must have termination resistors fitted at each end:  
|             | • one line impedance matching resistor.  
|             | • two RS485 bus polarisation resistors. |

| Address     | Adjustable between 1 and 127 using front panel switches only. The physical address is factory configured to 32 by default. |

| Diagnostic  | • Green LED on front panel indicates power presence, waiting for frames, communication established.  
|            | • Two orange LEDs show the status of the communication bus (transmission or reception). |

| Control     | Supply voltage compensation operates for variations up to ±20% of nominal voltage, using $V^2$ control |

| Parameters and operating mode | Read and write by digital communication  
|                              | (see Digital communication manual, part No. HA176664ENG). |

| Firing base time | Configurable over communication link (@ 50% of power):  
|                 | • 1 or 255 cycles (‘Burst mode’).  
|                 | The default base time is factory configured to 16 cycles. |
## CODING

### 7300S Current / Voltage / Fan / Configuration / Fuses / Input / Language / Options

<table>
<thead>
<tr>
<th>1. Nominal current per phase</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 amps</td>
<td>16A</td>
</tr>
<tr>
<td>25 amps</td>
<td>25A</td>
</tr>
<tr>
<td>40 amps</td>
<td>40A</td>
</tr>
<tr>
<td>63 amps</td>
<td>63A</td>
</tr>
<tr>
<td>80 amps</td>
<td>80A</td>
</tr>
<tr>
<td>100 amps</td>
<td>100A</td>
</tr>
<tr>
<td>125 amps</td>
<td>125A</td>
</tr>
<tr>
<td>160 amps</td>
<td>160A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Nominal line-to-line voltage</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 volts to 230 volts</td>
<td>230V</td>
</tr>
<tr>
<td>277 volts</td>
<td>277V</td>
</tr>
<tr>
<td>400 volts to 500 volts</td>
<td>500V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Fan</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 100 A: no fan</td>
<td>XXXX</td>
</tr>
<tr>
<td>≥ 125 A: fan</td>
<td></td>
</tr>
<tr>
<td>• 115 V supply</td>
<td>115V</td>
</tr>
<tr>
<td>• 230 V supply</td>
<td>230V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Load configuration</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Star without neutral</td>
<td>3S</td>
</tr>
<tr>
<td>Star with neutral</td>
<td>4S</td>
</tr>
<tr>
<td>Closed delta</td>
<td>3D</td>
</tr>
<tr>
<td>Open delta</td>
<td>6D</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. High-speed fuses</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyristor protection fuses only</td>
<td></td>
</tr>
<tr>
<td>• without microswitch</td>
<td>FUSE</td>
</tr>
<tr>
<td>• with microswitch</td>
<td>MSFU</td>
</tr>
<tr>
<td>(≤ 100 A: external fuses</td>
<td></td>
</tr>
<tr>
<td>≥ 125 A: internal fuses</td>
<td></td>
</tr>
</tbody>
</table>

No fuses or control of Short wave infrared elements | NONE |

<table>
<thead>
<tr>
<th>6. Input</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘On/off’ firing</td>
<td></td>
</tr>
<tr>
<td>DC logic signal 4.5 Vdc to 32 Vdc</td>
<td>LDC</td>
</tr>
<tr>
<td>AC logic signal 85 Vac to 253 Vac</td>
<td>HAC</td>
</tr>
</tbody>
</table>

‘Burst mode’ firing
Analogue DC signal 4 mA to 20 mA | ATP |

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>FRA</td>
</tr>
<tr>
<td>English</td>
<td>ENG</td>
</tr>
<tr>
<td>German</td>
<td>GER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8. Selected options</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>No options</td>
<td>NONE</td>
</tr>
<tr>
<td>Selection of options</td>
<td>YES</td>
</tr>
</tbody>
</table>
### 9. Alarm option

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLF</td>
<td>Partial load failure and Serious alarms</td>
</tr>
<tr>
<td>NONE</td>
<td>No alarms</td>
</tr>
</tbody>
</table>

**Alarm option Code (Options selected: YES)**

**For DLF option:**
- Resistive load with low temperature coefficient
- Short wave infrared elements*

**Without DLF option**

### 10. Load type

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTCL</td>
<td>Resistive load with low temperature coefficient</td>
</tr>
<tr>
<td>SWIR</td>
<td>Short wave infrared elements*</td>
</tr>
<tr>
<td>XXXX</td>
<td>Without DLF option</td>
</tr>
</tbody>
</table>

### 11. Alarm relay contact

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>Alarm relay contact</td>
</tr>
<tr>
<td>NO</td>
<td>Closed on alarm</td>
</tr>
<tr>
<td>NO</td>
<td>Open on alarm</td>
</tr>
<tr>
<td>XX</td>
<td>Without alarm option</td>
</tr>
</tbody>
</table>

**GRF or DLF option:**
- Alarm relay contact
  - Closed on alarm
  - Open on alarm

*DLF Option with SWIR loads is not UL approved.*

### 12. Communication option

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOP</td>
<td>Digital communication</td>
</tr>
<tr>
<td>NONE</td>
<td>No communication</td>
</tr>
</tbody>
</table>

**Communication option Code**

**Digital communication protocol:**
- Modbus®

### 13. Transmission speed

**Transmission speed Code**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9K6</td>
<td>Transmission speed: 9.6 kbaud</td>
</tr>
<tr>
<td>19K2</td>
<td>Transmission speed: 19.2 kbaud</td>
</tr>
<tr>
<td>XXXX</td>
<td>No communication</td>
</tr>
</tbody>
</table>

**Transmission speed Code (Comm. option other than NONE)**

### 14. Certification option

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>Without Certificate of ‘Compliance with Order’</td>
</tr>
<tr>
<td>CFMC</td>
<td>With certificate of ‘Compliance with Order’</td>
</tr>
</tbody>
</table>

**Without Certificate of ‘Compliance with Order’**

**With certificate of ‘Compliance with Order’**

### 15. Warranty Extension

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>Without warranty extension</td>
</tr>
<tr>
<td>CFMC</td>
<td>With warranty extension to 5 years</td>
</tr>
</tbody>
</table>
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INSTALLATION

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2. Chapter 2  INSTALLATION

2.1. SAFETY DURING INSTALLATION (MOUNTING AND WIRING)

Danger!

• 7300S solid state contactors must be installed and wired by qualified staff authorised to work on low voltage industrial electrical facilities.

• Units must be installed in a fan-cooled cabinet, to ensure that condensation and pollution are excluded, with a class of at least 2 (according to IEC 60664). We recommend fitting fan-cooled cabinets with a fan failure detection device or a safety cut-out triggered by the internal temperature of the cabinet. Cabinets must be closed and connected to the protective earth according to IEC 60364 or applicable national standards.

Important!

• Units must be mounted with the heatsink positioned vertically, and with no obstructions above or below the unit which could reduce or hamper air flow. If several units are fitted in the same cabinet, arrange them such that air from one unit is not drawn in by the unit above. The ambient temperature beneath the unit must not exceed 45°C. Leave a gap of at least 10 mm between adjacent units.

Important!

• Nominal currents correspond to use at ambient temperatures of no more than 45°C. Overheating may cause incorrect operation and may even lead to components being damaged.

Danger!

• It is the user’s responsibility to wire and protect the facility according to best practice and applicable standards. A suitable device, ensuring that the unit can be electrically isolated from the supply, must be installed upline to enable work to be performed safely. Conductor cross-sections should comply with IEC 60943. Only use copper cables and wires rated for use at 75°C. • Before connecting or disconnecting the unit check that power and control cables and leads are isolated from voltage sources. The protective earth must be connected before any other connections are made and should be the last cable to be disconnected. The protective earth connection terminal is marked with the symbol: ⬇️

Important!

• To ensure that 7300S solid state contactors comply with Electromagnetic Compatibility requirements, ensure that the panel or DIN rail to which they are attached is correctly grounded. The ground connection, designed to ensure ground continuity, is not in any way a substitute for the protective earth connection.

• Run low voltage and power cables in separate cable ducts or trays.
2.2. MOUNTING

2.2.1. TYPES OF MOUNTING

• DIN rail mounting - 16 A to 40 A only
• Bulkhead mounting with screws ≥ 63 A.

<table>
<thead>
<tr>
<th>DIN rail mounting (≤ 40 A only)</th>
<th>Bulkhead mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attachment plate</td>
<td>DIN rail</td>
</tr>
<tr>
<td>Two horizontal plates</td>
<td>Two symmetrical rails EN 50022</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2-1 Attachment details for both mounting types

2.2.2. Attachment plates (figures 2-1 to 2-4)

Two factory-fitted attachment plates on the rear of the 7300S solid state contactor are used:
• to clip the unit to a DIN rail, or
• to screw the unit to a bulkhead.

Each attachment plate has:
• attachment holes for bulkhead mounting, and
• two fixed hooks and two mobile hooks for clipping to a DIN rail.
  (the mobile hooks are moved using a catch and spring).

2.2.3. Mounting on DIN rails

• fix two symmetric DIN rails (for units rated 16 A to 40 A) in accordance with the unit dimensions and safety recommendations
• bring the unit up against the top rail, engaging the two fixed hooks on the top attachment plate
• push the unit against the rail
• clip the unit onto the bottom rail using the mobile hooks on the bottom attachment plate, ensuring that they are properly engaged.

To remove the unit:
• move the mobile hooks downwards by pulling the catch on the bottom attachment plate
• unclip the unit from the rail.

Figure 2-1 Attaching the 7300S to DIN rails
2.2.4. Bulkhead mounting

Figure 2-2 Units from 16 A to 40 A

Figure 2-3 Units from 63 A to 100 A

Figure 2-4 Units ≥ 125 A
2.3. WIRING
2.3.1. GENERAL CONNECTION DIAGRAM

The general connection diagram shows the power terminals (independent of the three-phase load configuration) and control connectors.

Figure 2-5 General connection diagram for ≤ 100 A units
Figure 2-6 General connection diagram for ≥ 125 A units
2.3.2. POWER CONNECTIONS

2.3.2.1. General

7300S solid state contactors comprise three channels controlled by thyristors.

Terminals 1/L1, 3/L2 and 5/L3 must be wired to the three-phase supply network.
Terminals 2/T1, 4/T2 and 6/T3 must be wired to the three-phase load.

The protective earth terminal PE (marked with the earth symbol) must be wired to the protective earth (see section ‘Safety during installation’ - page 2-2).

2.3.2.2. Power connection details

<table>
<thead>
<tr>
<th>Rating A</th>
<th>Terminal capacity</th>
<th>Torque Nm</th>
<th>Stripping length mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 to 25</td>
<td>2.5 to 6</td>
<td>13 to 9</td>
<td>1.2</td>
</tr>
<tr>
<td>40 to 63</td>
<td>6 to 16</td>
<td>9 to 5</td>
<td>1.8</td>
</tr>
<tr>
<td>80 to 100</td>
<td>16 to 35</td>
<td>5 to 2</td>
<td>3.8</td>
</tr>
<tr>
<td>125</td>
<td>50 to 120</td>
<td>0</td>
<td>16.4 (or 28.8)</td>
</tr>
<tr>
<td>160</td>
<td>70 to 120</td>
<td>00</td>
<td>M10 nut (17 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>wrench) to attach</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>eyelet and terminal.</td>
</tr>
</tbody>
</table>

Table 2-2 Power connection details for ratings from 16 A to 160 A
Conductor cross-sections should comply with IEC 60943.
Use 75°C copper wire only.

2.3.2.3. Three-phase load wiring schemes

Power connections to the unit depend on the load configuration.
The following four configuration schemes may be used for three-phase loads:
• star without neutral (3 connection wires, code 3S), figure 2-7
• closed delta (3 connection wires, code 3D), figure 2-8
• star with neutral (4 connection wires, code 4S), figure 2-9
• open delta (6 connection wires, code 6D), figure 2-10.

<table>
<thead>
<tr>
<th>Configuration type</th>
<th>Load voltage</th>
<th>Load current</th>
<th>Important note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Star without neutral</td>
<td>( V_{L-L} / \sqrt{3} )</td>
<td>Current in one line of thyristors ( I_{Th} )</td>
<td>-</td>
</tr>
<tr>
<td>Star with neutral</td>
<td>( V_{L-N} )</td>
<td>Current in one line of thyristors ( I_{Th} )</td>
<td>-</td>
</tr>
<tr>
<td>Closed delta</td>
<td>( V_{L-L} )</td>
<td>( I_{Th} / \sqrt{3} ) Balanced load</td>
<td>-</td>
</tr>
<tr>
<td>Open delta</td>
<td>( V_{L-L} )</td>
<td>Current in one line of thyristors ( I_{Th} )</td>
<td>It is essential to connect the loads as shown in figure 2-10</td>
</tr>
</tbody>
</table>

Table 2-3 Characteristics of different balanced three-phase load configuration schemes
\( V_{L-L} \): Line-to-line voltage; \( V_{L-N} \): Line-to-neutral voltage; \( I_{Th} \): Thyristor line current
Figure 2-7 Connecting a three-phase load using Star without neutral configuration

Figure 2-8 Connecting a three-phase load using Closed Delta configuration

Figure 2-9 Connecting a three-phase load using Star with Neutral configuration

Figure 2-10 Connecting a three-phase load using Open Delta configuration

Note: for units ≥ 125 A the fuses are internal
2.3.3. CONTROL TERMINAL BLOCKS

The control terminal blocks are plug-in screw connectors, located on the underside of the solid state contactor.

2.3.3.1. Control signal

The control signal input terminal block corresponds to the input type and solid state contactor version selected in the product code. The terminal names and numbers for the corresponding terminal blocks are marked on the front panel.

<table>
<thead>
<tr>
<th>Input code and type</th>
<th>Terminal block</th>
<th>Terminal number</th>
<th>Terminal reference</th>
<th>Terminal capacity mm²</th>
<th>Torque Nm</th>
<th>Stripping mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LDC</strong>: logic, 4.5 - 32 Vdc</td>
<td>LDC</td>
<td>11</td>
<td>0V LD</td>
<td>1.5</td>
<td>16</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>HAC</strong>: logic, 85 - 253 Vac</td>
<td>HAC</td>
<td>11</td>
<td>A1 A2</td>
<td>2.5</td>
<td>14</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>ATP</strong>: analogue, 4 - 20 mA DC</td>
<td>ATP</td>
<td>11</td>
<td>0V RI</td>
<td>1.5</td>
<td>16</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Table 2-4 Description of control input terminal block

**Important!**

- The DC inputs (LDC and ATP) are polarised. The ‘+’ of the control signal must be connected to terminal 12 (labelled LD for the LDC input and RI for the ATP input).
- If an RC snubber contact protection circuit is used (HAC input), the maximum capacitor value is **22 nF** for 240 Vac. Increasing this value may lead to continuous firing.

2.3.3.2. Alarm relay contact (option)

If one of the alarm options is fitted, an alarm relay contact is available on the ‘ALARM’ terminal block. Contact switching capacity: 0.25 A (maximum 250 Vac or 30 Vdc). The type of contact (closed or open on alarm) is selected on ordering and determines the terminal numbers.

<table>
<thead>
<tr>
<th>Option code</th>
<th>Terminal block</th>
<th>Terminal number</th>
<th>Terminal reference</th>
<th>Terminal capacity mm²</th>
<th>Torque Nm</th>
<th>Stripping mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DLF</strong>: DLF alarm and serious alarms</td>
<td>ALARM</td>
<td>73, 74</td>
<td>1a, 1b</td>
<td>2.5</td>
<td>14</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Table 2-5 Description of Alarm relay contact terminal block
2.3.3.3. Connecting the reference neutral voltage

To enable the DLF options to operate with 4S load configuration, the neutral voltage of the three-phase supply (reference neutral) must be applied to terminal 21, marked N (EXT connector, external voltage).

Terminal capacity: **2.5 mm²**; torque **0.7 Nm**.

This connection must be protected by a **1 A** fuse (see figure 2-11).

![Figure 2-11 Connecting the supply neutral voltage (code 4S and DLF)](image)

2.3.3.4. Fan power supply

The fan (current rating 125 A or higher) may be powered at **115 V** or **230 V** depending on the product code.

The fan power supply terminal block (marked ‘FAN’) has three terminals (16 to 18). Only one terminal (16 for 230 V or 17 for 115 V depending on the code) is to be used to connect to a phase of the supply. Terminal 18 (marked 0V) must be connected to the neutral of the external supply or to the second phase (if the supply is taken between two phases).

The fan power consumption is approx. 10 VA.

If a supply other than 230 V or 115 V is used, the fan must be powered via a transformer.

Terminal capacity: **2.5 mm²**; torque **0.7 Nm**.

![Figure 2-12 Typical fan power supply connection (code 230V, supply other than 230 or 115 V)](image)
2.3.3.5. Connecting the digital communication

Digital communication option basic diagram.
Please refer to the 7000 Digital Communication user manual ref: HA176664ENG.

Figure 2-13 Digital communication connection
Chapter  3

3. ALARMS (Options)

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### ALARM DIAGNOSTIC SUMMARY

The table below summarises all status LED information needed to **diagnose the fault**

<table>
<thead>
<tr>
<th>OPTIONS (Front panel)</th>
<th>Basic Version or options</th>
<th>DLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>● T° Red (≥ 125 A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● GRF Red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● DLF Orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● ON Green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● HEAT Green</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIAGNOSIS:**
- Ready for firing
- Firing, No alarms
- Over-temperature
- Firing stopped
- Thyristors short-circuit
- Total Load Failure on phase or channel indicated
- Partial Load Failure on phase indicated

<table>
<thead>
<tr>
<th>OPTIONS (Front panel)</th>
<th>Basic Version or options</th>
<th>DLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>● T° Red (≥ 125 A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● GRF Red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● DLF Orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● ON Green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● HEAT Green</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3-1 Diagnosing operation and alarms according to front panel LEDs status
3. Chapter 3 ALARMS (Options)

3.1. SAFETY MECHANISMS

The alarms on the 7200S solid state contactor protect the thyristors and the load against certain types of abnormal operation and provide the user with the information about the type of fault.

Danger!

- Alarms are not under any circumstances a replacement for personnel protection.
- The user is responsible for installing independent safety mechanisms which must be inspected regularly. Given the value of the requirement controlled by the 7300S, this is strongly recommended.

Eurotherm can supply various types of suitable alarm detector.

3.2. ALARMS SIGNALLING

![Led layout]

Figure 3-1 Layout of front panel LEDs with “DLF” option

3.3. ALARM STRATEGY

<table>
<thead>
<tr>
<th>Description</th>
<th>Signaling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DLF Alarms</strong></td>
<td></td>
</tr>
<tr>
<td>Serious Alarm : Total Load Failure TLF, Thyristor Shirt Circuit THSC, Over-temperature.</td>
<td>Alarm Relay Contact &amp; Corresponding LED lit on front panel</td>
</tr>
<tr>
<td>Partial Load Failure PLF : monitoring, setting, diagnosing</td>
<td></td>
</tr>
<tr>
<td><strong>Conduction stopped</strong></td>
<td>over-temperature fault detected (fan-cooled products ≥ 125 A)</td>
</tr>
<tr>
<td><strong>Alarm Relay</strong></td>
<td>Every alarm change the Alarm Relay Contact position. This contact is:</td>
</tr>
<tr>
<td></td>
<td>• Open on alarm or</td>
</tr>
<tr>
<td></td>
<td>• Closed on alarm (according to the code)</td>
</tr>
<tr>
<td></td>
<td>Cut off alarm contact capacity is 0.25 A (230 Vac or 30 Vdc)</td>
</tr>
<tr>
<td><strong>Memorisation and Reset</strong></td>
<td>No Alarm are memorised.'Partial Load Failure'signalling can temporarily be out of alarm using the push-button</td>
</tr>
</tbody>
</table>

Table 3-2 Summary of available alarms
### Table 3-3  LEDs for serious alarms or faults with ‘DLF’ options

<table>
<thead>
<tr>
<th>Fault</th>
<th>‘T°’ red</th>
<th>‘GRF’ red</th>
<th>‘DLF’ orange</th>
<th>‘HEAT’ green</th>
<th>Firing stopped</th>
<th>Temps de réaction typique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial Load Failure (PLF)</td>
<td>OFF</td>
<td>OFF</td>
<td>Flashing</td>
<td></td>
<td>ON or Flashing</td>
<td>5 s to 13 s</td>
</tr>
<tr>
<td>Total Load Failure (TLF)</td>
<td>OFF</td>
<td>ON</td>
<td>Flashing</td>
<td></td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Thyristor Short-Circuit (THSC)</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-temperature (T°)</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF*</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

* Even if the control signal is present.

The indicators for serious alarms detected return to normal (LEDs and relays in non-alarm position) after the fault condition ceases.

**Important!**

- The DLF LED is used to distinguish between TLF or THSC fault.
- The DLF indicator flashes in a particular way to indicate the channel on which the load failure has occurred (see figure 3-2). DLF option with SWIR is not UL approved.
- The red T° LED is only fitted for fan-cooled units (rating ≥ 125 A) and if one of the alarm options is selected.
3.3.1. Setting the DLF alarm

Adjusting PLF detection involves calculating and storing the value of the reference impedance from the measured rms current and voltage values. This can be set using the push button on the front panel. The PLF detection setting can only be adjusted (reference impedance recalculated) in the following conditions:

- rms voltage across load is greater than 40% of the nominal voltage
- rms current is greater than 30% of the rated current
- no over-temperature or thyristor short-circuit faults.
- each time PLF setting is required the three-phase load must be balanced.
- in order to guarantee the full scale sensitivity, settings must be done at the load’s nominal temperature.

Note: PLF settings stay memorised even if a supply cut-out occurred.

3.3.2. Partial or Total Load Failure Detection

Partial Load Failure PLF monitoring involves comparing the load impedance with a reference impedance stored during setting. This comparison allows the detection of the load impedance increase. The load impedance is calculated from the continuous measurement of the rms values of current and voltage. PLF detection is only possible under the following conditions:

- no over-temperature or thyristor short-circuit faults.
- rms voltage across the load greater than 40% of the nominal voltage and,
- rms load current greater than 5% of the rated current.

Total Load Failure TLF monitoring is only possible under the following conditions:

- no over-temperature or thyristor short-circuit faults.
- the rms voltage across load is greater than 40% of the nominal voltage.

3.3.3. Partial Load Failure Detection Sensitivity

Partial Load Failure Detection Sensitivity can be expressed in terms of a maximum number of load elements connected in parallel for which the unit can detect the failure of one element. The DLF sensitivity guaranteed for identical three-phase loads connected in parallel is:

- 3D coupling - 1 element out of 3
- 3S, 4S and 6D coupling - 1 element out of 4
3.4. SIGNALLING OF CHANNEL FOR LOAD FAULT

With the DLF option, the DLF LED flashes in particular ways to indicate the number of controlled channel (of the two thyristor channels) on which load failure (TLF or PLF) has occurred. Figure 4-3 shows the three types of flashing if a load failure is detected on one of the channels of the 7300S solid state contactor.

![Figure 3-2 Signalling of channel for load failure on the DLF LED](image.png)

**Important**!
- The number of times the DLF LED flashes indicates the thyristor channel number connected to the failed load phase.
- In 3S three-phased load configuration, the load phase connected to the channel indicated by the DLF LED has failed.
- In 3D three-phased load configuration, on one (or two) branch(es) of the delta connected to the channel indicated by the DLF LED has failed.

3.5. LOAD TYPE MATCHING

PLF detection is adapted to the load type. The type of load controlled is selected when ordering, with the product code:
- **LTCL** (Low Temperature Coefficient Load) or
- **SWIR** (Short Wave InfraRed)

3.6. DISABLING ALARMS AND DIAGNOSTICS FOR LOAD FAILURE SIGNALLING

PLF fault signalling (DLF indicator and relay) can be temporarily excluded from alarms, in order to diagnose the presence of the fault and the monitoring status, by pressing the ‘CHK / SET’ (Check / Setting) push button. If the fault persists, DLF signalling returns to the alarm position.
3.7. FUNCTIONS OF DLF ALARM PUSH BUTTON

The push button on the front panel of the unit with the DLF option is labelled: «CHK / SET» («Checking / Setting»).

Pushing this push button as shown on the timing diagrams below, sets and diagnoses the status of the PLF detection circuit.

3.7.1. Setting request

![Diagram showing setting request](Figure 3-3a PLF detection setting request)

3.7.2. Diagnosis

![Diagram showing diagnosis](Figure 3-3b PLF monitoring diagnosis)

3.7.3. Disabling

![Diagram showing disabling](Figure 3-3c Disabling PLF monitoring)
# Chapter 4

## 4. COMMISSIONING AND MAINTENANCE

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<td>4-4</td>
</tr>
</tbody>
</table>
4. Chapter 4  COMMISSIONING AND MAINTENANCE

4.1. SAFETY DURING COMMISSIONING AND MAINTENANCE

Please read carefully before commissioning the unit

**Important!**

- Eurotherm shall not be held responsible for any damage, injury, losses or expenses incurred by inappropriate use of the product or failure to comply with this manual.
- Accordingly the user is responsible for checking, before commissioning the unit, that all the nominal characteristics correspond to the conditions under which it is to be installed and used.

**Danger!**

- The product must be commissioned and maintained by qualified personnel, authorised to work in an industrial low voltage environment. Users must not attempt to access internal parts. The heatsink temperature may exceed 100°C. The heatsink remains hot for approx. 15 minutes after the unit is shut down. Avoid touching the heatsink even briefly while the unit is operating.

4.2. COMMISSIONING

4.2.1. CHECKING THE CHARACTERISTICS

Before powering up the unit, check that the identification code corresponds to the code specified on the order and that the characteristics are compatible with the facility.

**4.2.1.1. Load current**

The maximum load current must be less than or equal to the nominal current value of the solid state contactor, taking account of supply and load variations.

**4.2.1.2. Supply voltage**

The nominal voltage value must be greater than or equal to the line-to-line or line-to-neutral supply voltage (depending on the connection scheme).

Never use the unit on a supply with a voltage greater than the nominal value +10% as this could damage the protection components or even the thyristors.

**4.2.1.3. Input signal**

The signal type is factory configured depending on the option ordered. Check that the signal used corresponds to the input type indicated on the front panel of the unit (LDC, HAC or ATP).

**4.2.1.4. Load Type (DLF Option)**

For correct operation of the partial load failure detection system, ensures that load type used corresponds to the product code (LTCL or SWIR).
**4.2.2. CHECKING THE WIRING**

**4.2.2.1. Cut-off and isolation systems**

It is the user’s responsibility to wire and protect the facility according to best practice and applicable standards.

⚠️ **Danger!**

A suitable device ensuring that the unit can be electrically isolated from the supply must be installed upline to enable work to be performed safely.

**4.2.2.2. Protective earth, power and control connections**

- Before checking the wiring, ensure that the power and control wires are isolated from power sources.
- Check that the protective earth cable is connected to the earth terminal on the unit.
- Check that the wiring corresponds to the connection diagram (figure 2-5 for ratings up to 100 A and figure 2-6 for ratings of 125 A and above).
- For ratings of 125 A or more, check that the reference voltage is connected to terminal L2 on the EXT terminal block (figure 2-11).
- For fan-cooled units (125 A and above) check the fan power supply (voltage, connections and fuse).
- Check the polarity of DC input signals (code LDC or ATP) Table 2-4.

**4.2.3. POWER UP**

**4.2.3.1. Power and auxiliary voltages and input signal**

- Check that there is no input signal then power up the unit.
  - Check that there is no current in the load.
- Check the auxiliary voltage for COM options (Aux2 terminal block) see page 2-11.
- Apply the logic signal (LDC or HAC inputs) for a short period or the analogue signal with a low value (ATP input) and check that the load current appears and the ‘HEAT’ LED is lit during firing.
- Apply the necessary input signal.

**4.2.3.2. Adjust the partial load failure detection setting (DLF option).**

- Check that the DLF alarm operating conditions are correct and that the load failure detection conditions are met (page 3-5).
- The partial load failure detection settings are adjusted with the push button on the front panel of units fitted with the DLF option. The procedure and conditions for this setting are described in the ‘DLF option’ section in (page 3-7).
4.3. MAINTENANCE

- Every six months, check that the power and protective earth cables are correctly tightened.
- If the load parameters change, the operation of the PLF detection must be diagnosed (see ‘DLF option’ section - chapter 3).
- If a DLF alarm occurs, check the load wiring and condition of contacts. Use the push button to confirm the DLF alarm diagnosis.
- To ensure that the unit is cooled correctly, the heatsink should be cleaned regularly, depending on how dirty the environment is, as should the fan protection grille for fan-cooled units rated at 125 A or more.

Danger!
Power down the unit before cleaning and allow 15 minutes for it to cool down.

4.4. THYRISTOR PROTECTION FUSES

A high speed fuse protects the thyristors in the 7300S unit against excessive current. For current ratings up to 100 A the fuses are external. For current ratings of 125 A and above the fuses are internal, located in a special compartment, under a cover held by two captive screws.

Danger!
High-speed fuses do not provide protection for the installation. Upline protection must be fitted (non-high-speed fuses, circuit breakers).

If the ‘Fuse’ field of the product code is ‘NONE’ (i.e. the user did not order a thyristor protection fuse or the load comprises short wave infrared elements), the fuse is not supplied (ratings 16 A to 100 A) or is not installed inside the unit (ratings 125 A and over).

Important!
For all loads (other than short wave infrared elements), using a thyristor protection fuse other than the recommended fuses listed in the tables below voids the product guarantee.

An external high speed fuse protects the thyristors in 7300S units with a current rating of 16 A to 100 A.

An internal high speed fuse protects the thyristors in 7300S units with a current rating of 125 A to 160 A.

The product code indicates whether a fuse is included in the unit ordered and the type of fuse. With the FUSE or MSFU (Micro Switch FUse) codes, a fuse and fuse holder assembly (corresponding to the current rating) is supplied with the product.

- FUSE code: the fuse does not have a fuse blown striker bar
- MSFU code: the fuse has a striker bar and the fuse holder is fitted with a blown fuse microswitch to be connected by the customer.
## Commissioning

**Important!**

For all loads (other than short wave infrared elements), using a thyristor protection fuse other than the recommended fuse voids the product guarantee.

---

### Table 4-1  Tripolar Fuses without microswitch, recommended for rating 16 A to 100 A (code FUSE)

<table>
<thead>
<tr>
<th>Rating</th>
<th>A fuse part number</th>
<th>Fuses and fuse-holder assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Part number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16A</td>
<td>CH260034</td>
<td>FU3038/16A</td>
</tr>
<tr>
<td>25A</td>
<td>CH260034</td>
<td>FU3038/25A</td>
</tr>
<tr>
<td>40A</td>
<td>CH330054</td>
<td>FU3451/40A</td>
</tr>
<tr>
<td>63A</td>
<td>CS173087U080</td>
<td>FU3258/63A</td>
</tr>
<tr>
<td>80A</td>
<td>CS173087U100</td>
<td>FU3258/80A</td>
</tr>
<tr>
<td>100A</td>
<td>CS173246U160</td>
<td>FU3760/100A</td>
</tr>
</tbody>
</table>

### Table 4-2  Tripolar Fuses with microswitch, recommended for rating 16 A to 100 A (code MSFU)

<table>
<thead>
<tr>
<th>Rating</th>
<th>A fuse part number</th>
<th>Fuses and fuse-holder assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Part number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16A</td>
<td>CS176513U032</td>
<td>MSFU3451/16A</td>
</tr>
<tr>
<td>25A</td>
<td>CS176513U032</td>
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</tr>
<tr>
<td>40A</td>
<td>CS176513U050</td>
<td>MSFU3451/40A</td>
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<tr>
<td>63A</td>
<td>CS176461U080</td>
<td>MSFU3258/63A</td>
</tr>
<tr>
<td>80A</td>
<td>CS176461U100</td>
<td>MSFU3258/80A</td>
</tr>
<tr>
<td>100A</td>
<td>CS173246U160</td>
<td>MSFU3760/100A</td>
</tr>
</tbody>
</table>

### Table 4-3  Unipolar fuses recommended for rating ≥ 125 A

<table>
<thead>
<tr>
<th>Rating</th>
<th>Fuse part number with or without fuse-holder assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>125A</td>
<td>CS176762U160</td>
</tr>
<tr>
<td>160A</td>
<td>CS176762U315</td>
</tr>
</tbody>
</table>

**Note:** Thyristor protection is achieved with one external tripolar fuse and fuse-holder for 7300S units ≤ 100A.
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