MITSUBISHI ELECTRIC
*Changes for the Better*
FACTORY AUTOMATION

# MEsoftstart

Soft starter
Catalogue

## I00-100A/I01-200A/I02-390A
## I03-600A/I04-900A

## MEsoftstart/din
## D02/D03 (16 A and 32 A)

Art. No.: 472133
13 05 2019
Version A

Version check

# Contents

# 1 MEsoftstart/I – Industrial Models

## 1.1 Intelligent Motor Starting

Reducing stress on your plant's assets and electrical distribution…

| I00 – 100 A | I01 – 200 A | I02 – 390 A | I03 – 600 A | I04 – 900 A |
|---|---|---|---|---|

Mitsubishi Electric Europe's **MEsoftstart** is a microprocessor-controlled solid-state device to protect 3-phase electric motors, their power supply – and connected loads – against electrical, mechanical and thermal stress induced damage caused by large inrush of current to the motor at initial energisation.

### 1.1.1 Providing you with many benefits

**Function**

| | |
|---|---|
| **Wide output power range:** 11 kW to 1400 kW covered by just 5 models | Single soft starter family for all your needs - less training, lower spares inventory, more peace of mind |
| **Wide supply voltage options:** select from 400 V, 525 V and 690 V AC | Freedom to choose the correct soft starter irrespective of site location and voltages |
| Optimised for **high energy efficiency** IE3 and IE4 motors | Realise all your energy cost savings, despite the harsher starting current demands |
| **Wide range of applications:** pumping, ventilation, compressors plus material moving and processing | Pre-defined application profiles make it easier to get your project up and running |
| **Simple easy-to-setup** models using potentiometers only | No need to be a motor or soft starter expert with our "core" versions – simply follow the easy to use annotations on the dials for fast commissioning |
| **Advanced applications and capability** models available | Complex start-up modes and demanding applications readily addressed with our "pro" versions offering advanced configuration via touch-screen colour display and powerful PC App |
| Options: **internal bypass** contactor, **external bypass** contactor, or **no bypass** | Factory fitted bypass contactor makes fitting the soft starter easy – simply connect the supply and the motor and you are ready to go |

**MEsoftstart** limits this initial inrush of current by providing a gentle ramp of the voltage supplied to the motor to gradually bring it up to full speed – enabling you to start three-phase motors smoothly, easily, and efficiently and implement reliable machine concepts.

Soft starters are more commonly used during motor start-up, but **MEsoftstart** can also be applied to ensure controlled stopping, e.g. to prevent water hammer effects, correctly clear in-process materials from machines, etc.

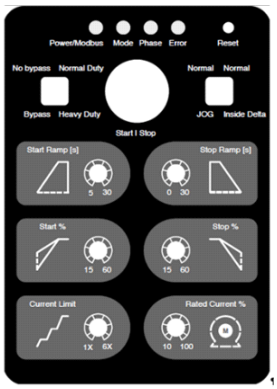
**MEsoftstart's** comprehensive motor protection package guarantees long term reliability while the external bypass connections or internal bypass options ensure flexibility and excellent performance – all in a robust, versatile design.

## 1.1.2 Reliable soft start for every application

**MEsoftstart** can easily integrate into your intelligent motor control solution to offer higher productivity, safer operation and shorter downtimes. They are a beneficial alternative to a variable speed drive where a more cost-effective, simple solution is required and are ideal for use in the following industries and applications:

- Pumps in industry and water utilities
- Fans & blowers
- Mixers & Agitators
- Conveyors
- Compressors (positive displacement and centrifugal)
- Hydraulic pumps
- Starting from weak power sources (e.g. generators, supplies with high regulation)

## 1.1.3 Two MEsoftstart variants available: "Core" and "Pro"

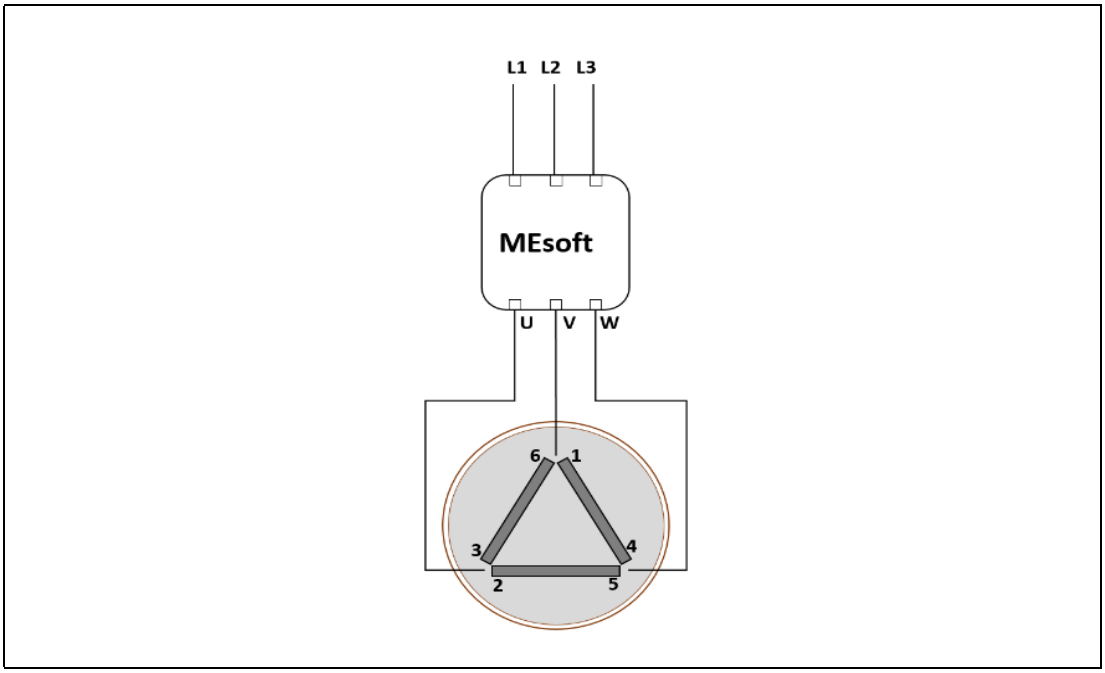
| Core | Pro |
|---|---|
| Low-cost, simple-to-configure using potentiometers for start ramp, stop ramp and motor size definition and a few slider switches to fully parameterise the soft starter. Advanced configuration, monitoring and control via RTU Modbus® optionally using the PC App. | Used for complex applications where more advanced configuration and control options are required.<br>Setting up, Monitoring and Control with full-function local colour touch screen, Modbus® TCP & RTU or using the PC App |
|  |  |

### Key features of the MEsoftstart family

| Feature | | Core | Pro |
|---|---|---|---|
| Wall mounted 3-phase soft starter | | ● | ● |
| Optimised soft start and current control | | ● | ● |
| Connection for 6-wire, inside-delta motor winding – economical substitute for star-delta starters | | ● | ● |
| Connection for 6-wire, inside-delta motor winding – economical substitute for star-delta starters | | ● | ● |
| Robust metal enclosure | | ● | ● |
| Parameterisation by potentiometer | | ● | — |
| Parameterisation by colour touch screen with basic and advanced menus | | — | ● |
| Parameterisation via Modbus® or using the PC Application | | ● | ● |
| No neutral conductor (N) required | | ● | ● |
| External bypass contactor connections or built-in bypass contactor | | ● | ● |
| Controlled soft stop option or coast stop | | ● | ● |
| Full monitoring and control, even if in bypass mode | | ● | ● |
| Open communication options: | via Modbus® RTU | ● | ● |
| | via Modbus® TCP | — | ● |
| | CC-link IE Field (soon) | — | ● |
| Remote start/stop (digital IO or communication link) | | ● | ● |
| Optimized for high efficiency motors (IE3) | | ● | ● |
| Monitoring of 3-phase voltage and current, power factor plus energy parameters | | ● | ● |
| Controller is line powered - no external supply needed | | ● | ● |
| External 24V DC can be used for configuring when the AC supply is unavailable | | ● | ● |
| Temperature monitoring – internal and optional motor temperature | | ● | ● |
| Relay outputs | READY, BYPASS, FAULT | ● | ● |
| | RUN; OVERLOAD ALARM; TEMPERATURE FAULT | — | ● |
| Comprehensive heatsink temperature monitoring and display to detect failures | | — | ● |
| 3 current sensors – one for each phase, even when soft starter is bypassed externally | | ● | ● |
| Control options | Kick start | — | ● |
| | Pedestal | — | ● |
| | Constant current ramp up | — | ● |
| | Voltage ramp: time-linear | ● | ● |
| | Voltage ramp: RMS-linear; S-Curve | — | ● |
| | Current limit start | ● | ● |
| | Application pre-sets: Default, Fan, Pump, HP Pump, Conveyor and Compressor curves | — | ● |
| Restart delay with built-in memory (settable maximum starts per hour) | | ● | ● |
| Protection and fault detection | Under and over voltage | ● | ● |
| | Phase current and voltage imbalance | ● | ● |
| | Phase voltage failure | ● | ● |
| | Motor thermal protection curves | ● | ● |
| | Underload and Overload | ● | ● |
| | Short circuit protection | ● | ● |
| | Internal thermal protection | ● | ● |
| Conformal coated electronics for harsh, corrosive environments | | ● | ● |

## 1.1.4 Selecting the correct MEsoftstart model for your application

It's simple to select the right soft starter for your application from just 5 models, whether your starting current needs lie in the range of 100 A to 1600 A, or nominal supply voltage needs to be 400 or 500–525 or 690 V AC. Each model offers a solution for a wide range of motor sizes and usage profiles.




**Normal connection**

Use the following tables to select the best **MEsoftstart** model based on your supply voltage, motor size, motor duty and motor starting current requirements.

Notes for interpreting the tables:

① Normal duty is defined as equal or less than 10 starts per hour (≥ 6 minutes between starts) and start ramp shorter than 30 s.

② Heavy duty is defined as more than 10 starts per hour (<6 minutes between starts) or start ramp longer than 30 s.

(In the case of motors with heavy duty starting requirements, use only the values from columns marked "Heavy duty" above.)

③ Starting current expressed as a percentage of motor rated full load current (FLC) calculated using a power factor of 0.8.

④ De-rate all current values by 1.4 % per °C for ambient temperatures above 50 °C.

⑤ Harsh operational environment means operating above 40 °C, high humidity/dust and altitude >1000 m above sea-level.

***Table 1:*** **Model selection – normal connection, 400 V supply**

| **Model** | | **MEsoftstart/I00 (100 A)** | | **MEsoftstart/I01 (200 A)** | | **MEsoftstart/I02 (390 A)** | | **MEsoftstart/I03 (600 A)** | | **MEsoftstart/I04 (900 A)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duty | | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy |
| Motor Size [KW] | FLC [A] | | | | | | | | | | |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) |
| 11 | 20 | 1200 % | 625 % | | | | | | | | |
| 15 | 28 | 857 % | 446 % | | | | | | | | |
| 18.5 | 34 | 706 % | 368 % | | | | | | | | |
| 22 | 40 | 600 % | 313 % | 1200 % | 625 % | | | | | | |
| 30 | 55 | 436 % | 227 % | 873 % | 455 % | | | | | | |
| 37 | 67 | 358 % | 187 % | 716 % | 373 % | 1090 % | 582 % | | | | |
| 45 | 82 | 293 % | | 585 % | 305 % | 890 % | 476 % | | | | |
| 55 | 100 | 240 % | | 480 % | 250 % | 730 % | 390 % | | | | |
| 75 | 136 | | | 353 % | 184 % | 537 % | 287 % | 1059 % | 551 % | | |
| 90 | 163 | | | 294 % | | 448 % | 239 % | 883 % | 460 % | 982 % | 552 % |
| 110 | 199 | | | 241 % | | 367 % | 196 % | 724 % | 377 % | 804 % | 452 % |
| 132 | 239 | | | 201 % | | 305 % | | 603 % | 314 % | 669 % | 377 % |
| 160 | 289 | | | | | 253 % | | 498 % | 260 % | 554 % | 311 % |
| 200 | 361 | | | | | 202 % | | 399 % | 208 % | 443 % | 249 % |
| 250 | 452 | | | | | | | 319 % | | 354 % | 199 % |
| 315 | 569 | | | | | | | 253 % | | 281 % | |
| 355 | 641 | | | | | | | | | 250 % | |
| 400 | 722 | | | | | | | | | 222 % | |
| 450 | 812 | | | | | | | | | 197 % | |

**To select the appropriate MEsoftstart model, just follow these simple steps:**

① Using the Motor Size as starting point, track across the table to the shaded column(s) for that size.

② Select the appropriate column: Normal duty or Heavy duty.

③ Based on the motor manufacturer's starting current (as a percentage of the motor FLC), check whether the selected soft starter model can deliver this starting current - if not, go to the next larger **MEsoftstart** model's selection chart.

**Example 1** ▽ Target application is a fan in a 400 V distribution, which does not require high starting torque.

A normal 3-wire configuration 90 kW fan motor is specified, with normal duty starting: ramp-start of 20 s duration, requiring no more than 240 % of the motor's running current during start-up:

① Select the 90 kW row

② Find the intersect of this row with column (g) for **MEsoftstart/I01** and column (j) for -**/I02**.

③ Check the maximum available starting current values: 294 % for model **I01** and 448 % for model **I02** in this case

Conclusion: The available starting current from **both** models is greater than the specified 240 %

⟶ Hence select the smaller model **MEsoftstart/I01** as ideal for this application.

△

**Example 2** ▽ The application is a compressor or conveyor in a 400 V distribution, requiring high starting torque.

The same 90 kW motor configuration - this time driving a compressor motor - is specified with heavy duty starting: slow ramp longer than 30 s duration and approximately 400 % of the motor's running current during start-up.

① Select the 90 kW row.

② Find the intersect of this row with all "Heavy duty" columns - column (k) for **MEsoftstart/I02** and column (n) for -**/I03**.

③ Check the maximum available starting current values: 239 % for model **I02** and 460 % for model **I03** in this case

Conclusion: The available starting current from only model **I03** is greater than the specified 400 %

⟶ Hence select model **MEsoftstart/I03** as suitable for this heavy duty application.

△

***Table 2:*** **Model selection – normal connection, 525 V supply**

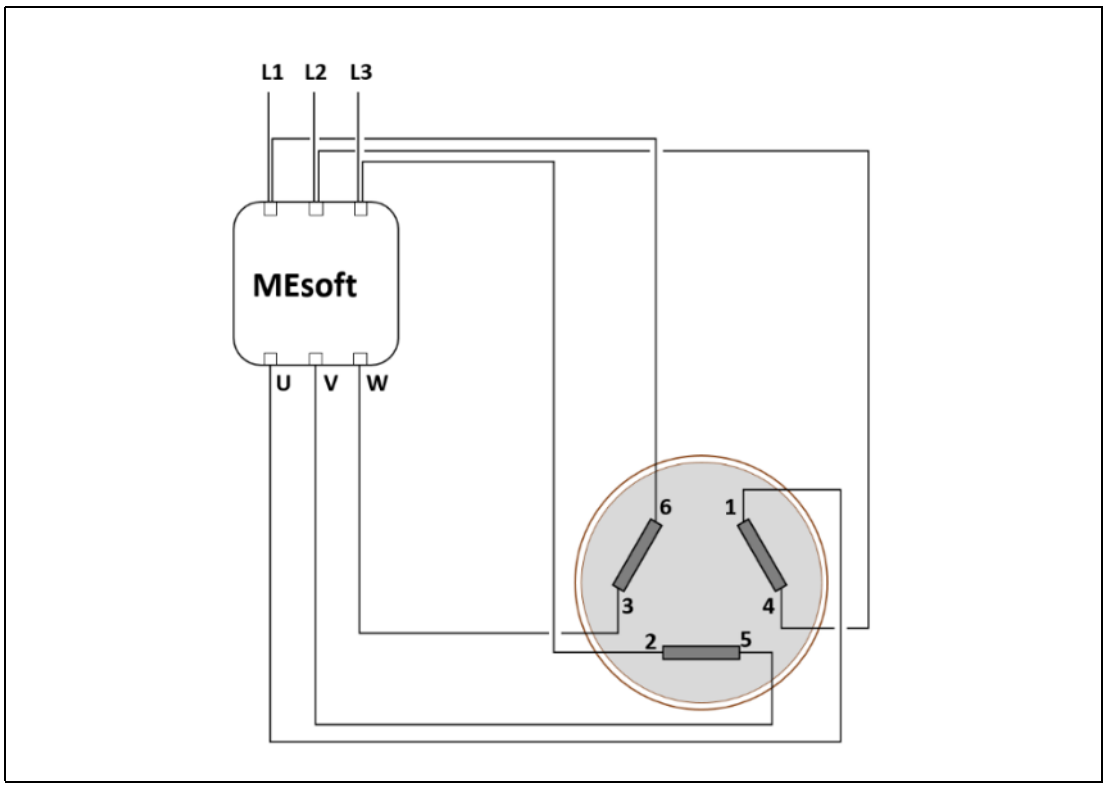
| **Model** | | **MEsoftstart/I00 (100 A)** | | **MEsoftstart/I01 (200 A)** | | **MEsoftstart/I02 (390 A)** | | **MEsoftstart/I03 (600 A)** | | **MEsoftstart/I04 (900 A)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duty | | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy |
| Motor Size [KW] | FLC [A] | | | | | | | | | | |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) |
| 15 | 21 | 1143 % | 595 % | | | | | | | | |
| 18.5 | 26 | 923 % | 481 % | | | | | | | | |
| 22 | 31 | 774 % | 403 % | | | | | | | | |
| 30 | 42 | 571 % | 298 % | 1143 % | 595 % | | | | | | |
| 37 | 51 | 471 % | 245 % | 941 % | 490 % | | | | | | |
| 45 | 62 | 387 % | 202 % | 774 % | 403 % | 1177 % | 629 % | | | | |
| 55 | 76 | 316 % | | 632 % | 329 % | 961 % | 513 % | | | | |
| 75 | 104 | 231 % | | 462 % | 240 % | 702 % | 375 % | | | | |
| 90 | 124 | | | 387 % | 202 % | 598 % | 315 % | 1161 % | 605 % | | |
| 110 | 152 | | | 316 % | | 480 % | 257 % | 947 % | 493 % | 1053 % | 592 % |
| 132 | 182 | | | 264 % | | 401 % | 214 % | 791 % | 412 % | 879 % | 495 % |
| 160 | 220 | | | | | 332 % | | 655 % | 341 % | 727 % | 409 % |
| 200 | 275 | | | | | 265 % | | 524 % | 273 % | 582 % | 327 % |
| 250 | 344 | | | | | 212 % | | 419 % | 218 % | 465 % | 262 % |
| 315 | 434 | | | | | | | 332 % | | 369 % | 207 % |
| 355 | 488 | | | | | | | 295 % | | 328 % | 184 % |
| 400 | 550 | | | | | | | 262 % | | 291 % | |
| 450 | 619 | | | | | | | | | 258 % | |
| 500 | 688 | | | | | | | | | 233 % | |
| 560 | 770 | | | | | | | | | 208 % | |
| 630 | 867 | | | | | | | | | 185 % | |

***Table 3:*** **Model selection – normal connection, 690 V supply**

| **Model** | | **MEsoftstart/I00 (100 A)** | | **MEsoftstart/I01 (200 A)** | | **MEsoftstart/I02 (390 A)** | | **MEsoftstart/I03 (600 A)** | | **MEsoftstart/I04 (900 A)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duty | | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy |
| Motor Size [KW] | FLC [A] | | | | | | | | | | |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) |
| 15 | 16 | | | | | | | | | | |
| 18.5 | 20 | 1200 % | 625 % | | | | | | | | |
| 22 | 24 | 1000 % | 521 % | | | | | | | | |
| 30 | 32 | 750 % | 391 % | | | | | | | | |
| 37 | 39 | 615 % | 321 % | 1231 % | 641 % | | | | | | |
| 45 | 48 | 500 % | 260 % | 1000 % | 521 % | | | | | | |
| 55 | 58 | 414 % | 216 % | 828 % | 431 % | 1259 % | 672 % | | | | |
| 75 | 79 | 304 % | | 608 % | 316 % | 924 % | 494 % | | | | |
| 90 | 95 | 253 % | | 505 % | 263 % | 768 % | 411 % | | | | |
| 110 | 116 | | | 414 % | 216 % | 629 % | 336 % | 1241 % | 647 % | | |
| 132 | 139 | | | 345 % | 180 % | 525 % | 281 % | 1036 % | 540 % | 1151 % | 647 % |
| 160 | 168 | | | 286 % | | 435 % | 232 % | 857 % | 446 % | 952 % | 536 % |
| 200 | 210 | | | | | 348 % | 186 % | 686 % | 357 % | 762 % | 429 % |
| 250 | 262 | | | | | 279 % | | 550 % | 286 % | 611 % | 344 % |
| 315 | 330 | | | | | 221 % | | 436 % | 227 % | 485 % | 273 % |
| 355 | 372 | | | | | 196 % | | 387 % | 202 % | 430 % | 242 % |
| 400 | 419 | | | | | | | 344 % | | 382 % | 215 % |
| 450 | 471 | | | | | | | 306 % | | 340 % | 191 % |
| 500 | 523 | | | | | | | 275 % | | 306 % | |
| 560 | 586 | | | | | | | 246 % | | 273 % | |
| 630 | 659 | | | | | | | | | 243 % | |
| 710 | 743 | | | | | | | | | 215 % | |
| 800 | 837 | | | | | | | | | 191 % | |

**Inside-delta motor connection**

In a 6-wire or inside-delta connection to a motor, the soft starter switching elements are connected inside the delta (in series with each motor winding). This means that the soft starter carries only phase current, not line current, with each phase's switching circuitry being exposed to only 58 % of the running (and starting) current of a normal 3-wire connection. This allows the soft starter to control a motor of larger than normal full load current, or stated differently, that a soft starter with a lower current rating may be an appropriate and cost-effective solution.
When using an inside-delta connection, a main contactor or shunt trip MCCB must also be used to disconnect the motor and soft starter from the supply in the event of a trip.
Inside-delta connection can simplify replacement of star/delta starters because the existing wiring can be used and will reduce installation cost.




**NOTE**

Only motors that allow each end of all three motor windings to be connected separately can be controlled using the inside-delta connection method.

Use the following tables as before to select the best **MEsoftstart** model based on your supply voltage, motor size, motor duty and motor starting current requirements (Including whether the soft starter will be bypassed or not).

***Table 4:*** **Model selection – inside-delta connection, 400 V supply**

| **Model** | | **MEsoftstart/I00 (100 A)** | | **MEsoftstart/I01 (200 A)** | | **MEsoftstart/I02 (390 A)** | | **MEsoftstart/I03 (600 A)** | | **MEsoftstart/I04 (900 A)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duty | | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy |
| Motor Size [KW] | FLC [A] | | | | | | | | | | |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) |
| 18.5 | 20 | 1200 % | 625 % | | | | | | | | |
| 22 | 24 | 1000 % | 521 % | | | | | | | | |
| 30 | 32 | 750 % | 391 % | | | | | | | | |
| 37 | 39 | 615 % | 321 % | 1231 % | 641 % | | | | | | |
| 45 | 48 | 500 % | 260 % | 1000 % | 521 % | | | | | | |
| 55 | 58 | 414 % | 216 % | 828 % | 431 % | 1259 % | 672 % | | | | |
| 75 | 79 | 304 % | | 608 % | 316 % | 924 % | 494 % | | | | |
| 90 | 95 | 253 % | | 505 % | 263 % | 768 % | 411 % | | | | |
| 110 | 116 | | | 414 % | 216 % | 629 % | 336 % | 1241 % | 647 % | | |
| 132 | 139 | | | 345 % | 180 % | 525 % | 281 % | 1036 % | 540 % | 1151 % | 647 % |
| 160 | 168 | | | 286 % | | 435 % | 232 % | 857 % | 446 % | 952 % | 536 % |
| 200 | 210 | | | | | 348 % | 186 % | 686 % | 357 % | 762 % | 429 % |
| 250 | 262 | | | | | 279 % | | 550 % | 286 % | 611 % | 344 % |
| 315 | 330 | | | | | 221 % | | 436 % | 227 % | 485 % | 273 % |
| 355 | 372 | | | | | 196 % | | 387 % | 202 % | 430 % | 242 % |
| 400 | 419 | | | | | | | 344 % | | 382 % | 215 % |
| 450 | 471 | | | | | | | 306 % | | 340 % | 191 % |
| 500 | 524 | | | | | | | 275 % | | 305 % | |
| 560 | 587 | | | | | | | 245 % | | 273 % | |
| 630 | 660 | | | | | | | | | 242 % | |
| 710 | 743 | | | | | | | | | 215 % | |
| 800 | 838 | | | | | | | | | 191 % | |

***Table 5:*** **Model selection – inside-delta connection, 525 V supply**

| **Model** | | **MEsoftstart/I00 (100 A)** | | **MEsoftstart/I01 (200 A)** | | **MEsoftstart/I02 (390 A)** | | **MEsoftstart/I03 (600 A)** | | **MEsoftstart/I04 (900 A)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duty | | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy |
| Motor Size [KW] | FLC [A] | | | | | | | | | | |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) |
| 22 | 18 | 1333 % | 694 % | | | | | | | | |
| 30 | 24 | 1000 % | 521 % | | | | | | | | |
| 37 | 30 | 800 % | 417 % | | | | | | | | |
| 45 | 36 | 667 % | 347 % | 1333 % | 694 % | | | | | | |
| 55 | 44 | 545 % | 284 % | 1091 % | 568 % | | | | | | |
| 75 | 60 | 400 % | 208 % | 800 % | 417 % | 1217 % | 650 % | | | | |
| 90 | 72 | 333 % | | 667 % | 347 % | 1014 % | 542 % | | | | |
| 110 | 88 | 273 % | | 545 % | 284 % | 830 % | 443 % | | | | |
| 132 | 106 | | | 453 % | 236 % | 689 % | 368 % | | | | |
| 160 | 128 | | | 375 % | 195 % | 570 % | 305 % | 1125 % | 586 % | | |
| 200 | 160 | | | 300 % | | 456 % | 244 % | 1014 % | 469 % | 1000 % | 563 % |
| 250 | 200 | | | 240 % | | 365 % | 195 % | 720 % | 375 % | 800 % | 450 % |
| 315 | 252 | | | | | 290 % | | 571 % | 298 % | 635 % | 357 % |
| 355 | 284 | | | | | 257 % | | 507 % | 264 % | 563 % | 317 % |
| 400 | 319 | | | | | 229 % | | 451 % | 235 % | 502 % | 282 % |
| 450 | 359 | | | | | 203 % | | 401 % | 209 % | 446 % | 251 % |
| 500 | 399 | | | | | | | 361 % | 188 % | 401 % | 226 % |
| 560 | 447 | | | | | | | 322 % | | 358 % | 201 % |
| 630 | 503 | | | | | | | 286 % | | 318 % | |
| 710 | 567 | | | | | | | 254 % | | 282 % | |
| 800 | 638 | | | | | | | | | 251 % | |
| 900 | 718 | | | | | | | | | 223 % | |
| 1000 | 798 | | | | | | | | | 201 % | |

***Table 6:*** **Model selection – inside-delta connection, 690 V supply**

| **Model** | | **MEsoftstart/I00 (100 A)** | | **MEsoftstart/I01 (200 A)** | | **MEsoftstart/I02 (390 A)** | | **MEsoftstart/I03 (600 A)** | | **MEsoftstart/I04 (900 A)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duty | | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy | Normal | Heavy |
| Motor Size [KW] | FLC [A] | | | | | | | | | | |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) |
| 30 | 19 | 1263 % | 658 % | | | | | | | | |
| 37 | 23 | 1043 % | 543 % | | | | | | | | |
| 45 | 28 | 857 % | 446 % | | | | | | | | |
| 55 | 34 | 706 % | 368 % | | | | | | | | |
| 75 | 46 | 522 % | 272 % | 1043 % | 543 % | | | | | | |
| 90 | 55 | 436 % | 227 % | 873 % | 455 % | | | | | | |
| 110 | 67 | 358 % | 187 % | 716 % | 373 % | 1090 % | 582 % | | | | |
| 132 | 81 | 296 % | | 593 % | 309 % | 901 % | 481 % | | | | |
| 160 | 98 | 245 % | | 490 % | 255 % | 745 % | 398 % | | | | |
| 200 | 122 | | | 393 % | 205 % | 598 % | 320 % | 1180 % | 615 % | | |
| 250 | 152 | | | 316 % | | 480 % | 257 % | 947 % | 493 % | 1053 % | 592 % |
| 315 | 192 | | | 250 % | | 380 % | 203 % | 750 % | 391 % | 833 % | 469 % |
| 355 | 216 | | | | | 338 % | 181 % | 667 % | 347 % | 741 % | 417 % |
| 400 | 243 | | | | | 300 % | | 593 % | 309 % | 658 % | 370 % |
| 450 | 273 | | | | | 267 % | | 527 % | 275 % | 586 % | 330 % |
| 500 | 304 | | | | | 240 % | | 474 % | 247 % | 526 % | 296 % |
| 560 | 340 | | | | | 215 % | | 424 % | 221 % | 471 % | 265 % |
| 630 | 383 | | | | | 191 % | | 376 % | 196 % | 418 % | 235 % |
| 710 | 431 | | | | | | | 334 % | | 371 % | 209 % |
| 800 | 486 | | | | | | | 296 % | | 329 % | 185 % |
| 900 | 546 | | | | | | | 264 % | | 293 % | |
| 1000 | 607 | | | | | | | | | 264 % | |
| 1120 | 680 | | | | | | | | | 235 % | |
| 1400 | 850 | | | | | | | | | 188 % | |

## 1.1.5 Soft Starter Bypass Contactors

Use a soft start bypass contactor, either internal or external, to allow an application to run continuously after the start cycle is completed. The contactor will open once a stop or fault command is detected. All **MEsoftstart** soft starter models are fully solid state, meaning that no bypass is needed theoretically (being IEC AC-53a rated for running continuously on a squirrel-cage motor).
All **MEsoftstart** soft starter models provide a control signal to the internal or external bypass contactor giving the ability to close the bypass contactor once the motor is fully running (and inversely, to open the bypass contactor when the motor needs to be stopped).
A bypass contactor diverts the current that flows through the soft starter switching circuits to minimise thermal build-up in the soft starter power electronics during the time that the motor is running. This provides maximum efficiency and extends the life of the soft starter switching elements as they only work during the start and stop cycles of the motor.

**When to use a bypass contactor (internal or external) for the soft starter?**

Use a bypass contactor for motors which are stopped and started rarely – no more than 28 starts per hour (duty cycle 95 % or higher). Here energy savings can be made since the soft starter switching circuit losses are avoided when the motor is running and the bypass contactor is closed.

**NOTE**

The Mitsubishi S-N range of contactors will last more than 20 years when the motor is stopped and started less than 28 times per hour.

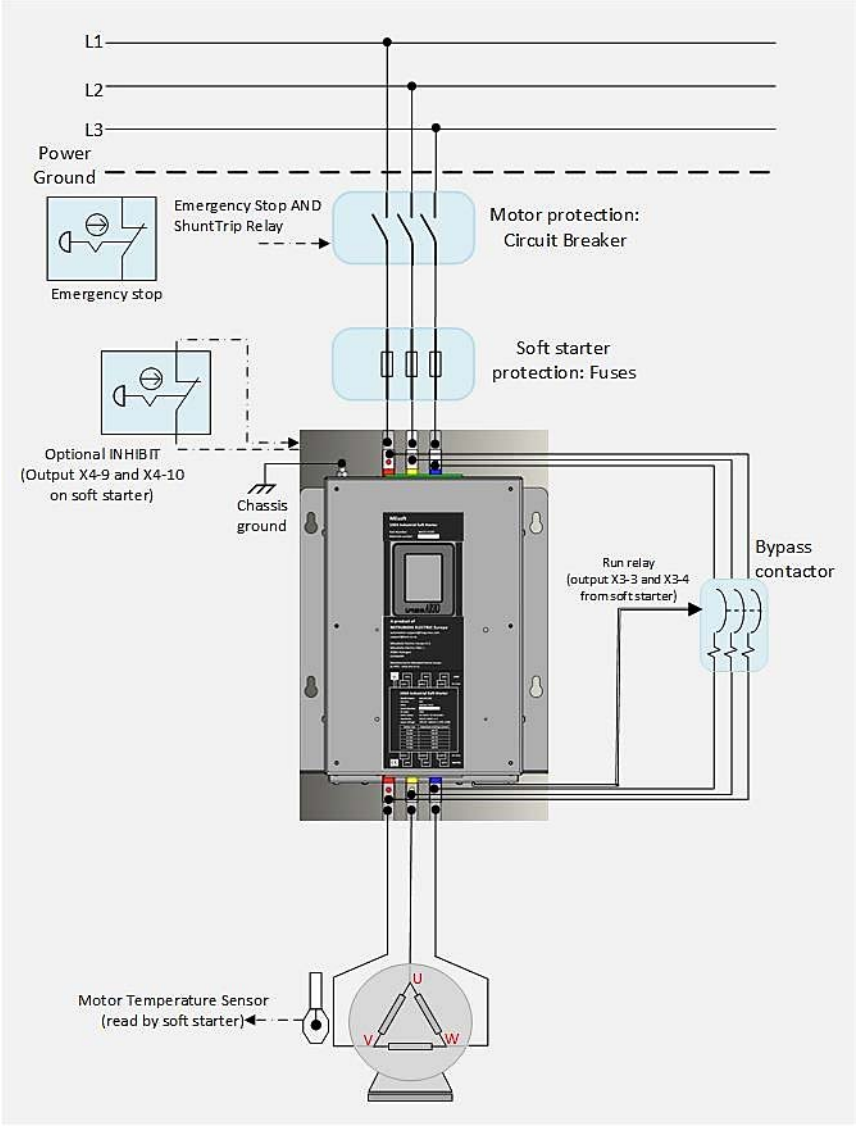
**When to use the soft starter without a bypass contactor?**

We do not recommend the use a bypass contactor for motors that are stopped and started more than 28 times per hour – here an external contactor would become rapidly worn due to the many switching cycles.

Where fitted, **MEsoftstart's** internal bypass contactor is rated at or above the continuous current of the soft starter. If an external bypass contactor is to be fitted, the user may select a smaller AC3 rated bypass contactor from the Mitsubishi series of non-reversing magnetic contactors, according to the full load current of the motor.

### 1.1.6 Soft Starter and Peripheral Devices

The diagram below shows a **MEsoftstart** soft starter in a typical installation including associated peripheral devices. The items in are further described in table 7 below.




**WARNING:**

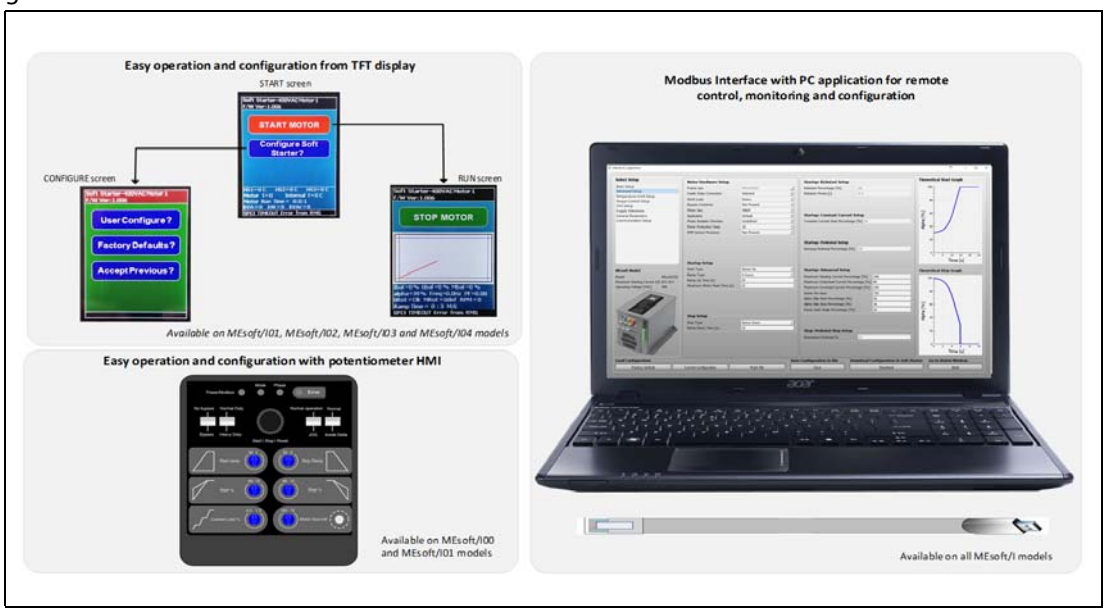
***Always check the nameplate information on your motor before designing the peripheral devices.***

***Table 7:*** **Peripheral devices in a soft starter installation**

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Soft starter (MEsoftstart/I00, -I01, -I02, -I03, and -I04)</td><td>The MEsoftstart soft starter connects to the supply voltage on the top side and to the motor on the bottom side.</td></tr>
<tr><td>Moulded case circuit breaker (MCCB)</td><td>The circuit breaker must be selected according to the maximum current of the motor. The circuit breaker should ideally be controllable from an Emergency Stop button.</td></tr>
<tr><td>Fuses</td><td>The fuses are required to protect the soft starter SCRs against excessive currents. The fuses should ideally be in line between the circuit breaker and the soft starter, and outside of the delta for 6-wire installations. The fuses should be selected as follows for the different MEsoftstart models:
<table>
<tr><th>Model</th><th>Min. fuse rating</th><th>Max $I^2t$ rating</th><th>Bypass contactor</th></tr>
<tr><td>MEsoftstart/I00</td><td>360 A</td><td>tba</td><td>S-N125</td></tr>
<tr><td>MEsoftstart/I01</td><td>720 A</td><td>125000</td><td>S-N220</td></tr>
<tr><td>MEsoftstart/I02</td><td>1095 A</td><td>322000</td><td>S-N400</td></tr>
<tr><td>MEsoftstart/I03</td><td>2400 A</td><td>1200000</td><td>S-N600</td></tr>
<tr><td>MEsoftstart/I04</td><td>2400 A</td><td>1200000</td><td>S-N800</td></tr>
</table></td></tr>
<tr><td>Bypass contactor<br>(Applicable only to MEsoftstart models without built-in bypass contactor.)</td><td>Bypass contactors can be installed (either internal to the soft starter housing or externally) to run the motor when at full speed.<br>- The soft starter's "RUN" discrete output signal should be used to control the bypass contactor.<br>- Select the bypass contactor according to the maximum running current of the motor as indicated on the motor manufacturer's label. If the motor is wired in an inside-delta circuit, the bypass contactor may be selected to be 58 % of the motor rated running current.<br>- Refer to Mitsubishi Electric's range of non-reversing magnetic contactors - the table above shows the recommended contactor models.</td></tr>
<tr><td>Bypass contactor relay circuit breaker<br>(Only applicable to MEsoftstart models without built-in bypass contactor.)</td><td>This circuit breaker is a 2 A circuit breaker protecting the Soft starter output signal that activates the external Bypass contactor via a 50/60 Hz coil. The contactor coil is powered from the supply voltage and should be selected according to the supply voltage.</td></tr>
<tr><td>Emergency stop</td><td>A STOP button that will open the MCCB to disconnect all power to the soft starter and motor.</td></tr>
<tr><td>Inhibit knob</td><td>The activation of the INHIBIT button will cause the soft starter to stop the motor and when released, to start the motor again as follows:<br>- The soft starter will stop the motor (in the manner as configured for stop e.g. ramp-down or coasting). After the motor is completely stopped, and the delay between motor starts has elapsed, the soft starter will check for the release of the inhibit button.<br>- If the inhibit button is released (and all other conditions are still in place to start the motor e.g. start signal present if in Remote control mode), the soft starter will again ramp-up the motor in the manner as configured.<br>- The Inhibit knob may be used e.g. to stop and start a conveyor belt. Note that the inhibit function is not related to the "REMOTE" configuration setting where e.g. a PLC is used to control the soft starter.</td></tr>
<tr><td>Motor temperature sensor</td><td>Optional motor temperature sensor is read by the soft starter. The soft starter uses this reading to protect the motor from overheating.</td></tr>
<tr><td>Induction motor</td><td>Configured as a 3-wire motor for normal delta connection or 6-wire for inside-delta wiring.</td></tr>
</table>

## 1.1.7 Configuring / Parameterising MEsoftstart

**MEsoftstart** soft starters are easy to set up using potentiometers and switches on the Core variants, or a built-in TFT colour touch screen on the Pro variants. Both variants can be setup and monitored or an application running on a Windows PC, tablet or laptop. These HMIs provide the user with the capability to configure the soft starter and give a clear indication of the motor's start-up (or shutdown) progress and soft starter status.




### Setup and parameterisation devices

Parameterisation can be done as follows on the different models:

| Model | Potentiometers | Touch screen | Windows app |
|---|---|---|---|
| **MEsoftstart/I00** | X (core) | | X (both) |
| **MEsoftstart/I01**① | X (core) | X (pro) | X (both) |
| **MEsoftstart/I02** | | X (pro) | X (both) |
| **MEsoftstart/I03** | | X (pro) | X (both) |
| **MEsoftstart/I04** | | X (pro) | X (both) |

① Select the appropriate model code when ordering, either Potentiometer or TFT setup

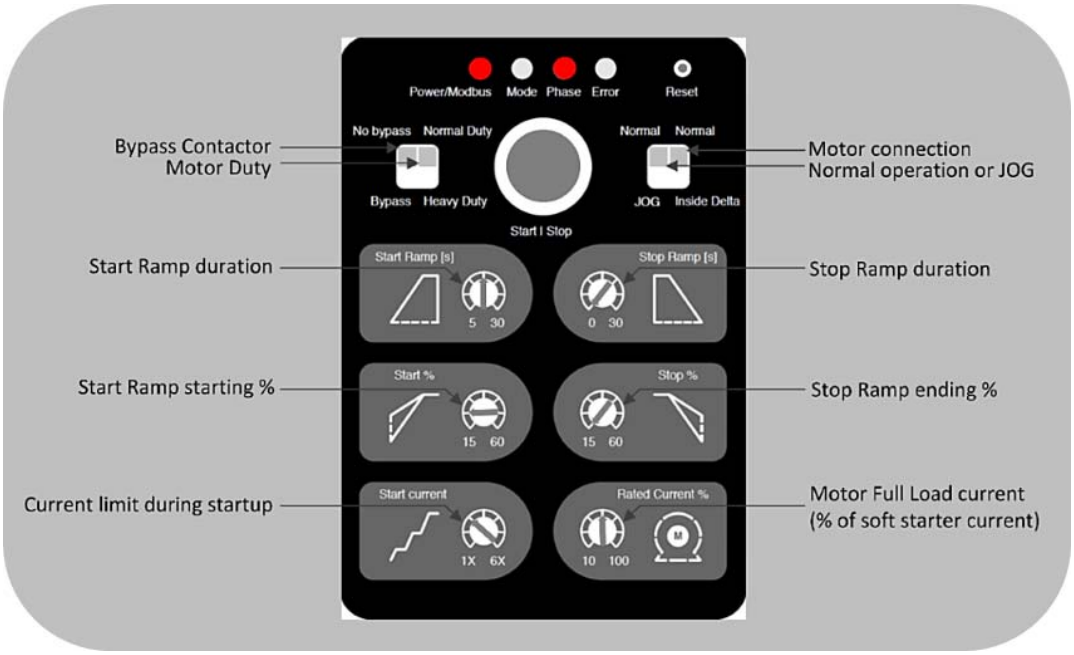
### Setup and parameterisation categories

The following setup categories are available using the touch-screen or the Windows app.

***Table 8:*** **MEsoftstart Pro-variant configuration parameters**

| Parameter group | Parameters |
|---|---|
| Basic Setup – Motor Hardware | • Inside Delta<br>• Workload Normal/Heavy<br>• Bypass Contactor<br>• Motor Size kW (depends on frame size)<br>• Motor Application<br>• Phase Rotation<br>• Protection Class<br>• RPM Sensor Presence |
| Basic Setup – Start Setup | • Start Type<br>• Ramp Type<br>• Ramp Up Time<br>• Maximum Starting Times |
| Basic Setup - Stop Setup | • Stop Type<br>• Ramp Down Time<br>• Ramp End Angle % |
| Advanced Setup | • Kickstart Voltage %<br>• Kickstart Period<br>• Constant Current %<br>• Pedestal RampUp %<br>• Pedestal RampDown %<br>• MSC %<br>• MULC %<br>• MOLC %<br>• Maximum Starts/Hour<br>• Ramp Start Angle %<br>• Alpha Skip Start %<br>• Alpha Skip Stop % |
| Temperature Setup | • Heatsink Fan Control<br>• Maximum Motor Temp<br>• Heatsink Restart Temp<br>• Motor Restart Temp<br>• Heatsink Fan Start<br>• Motor Temp Selection |
| Jog Control Setup | • Jog Motor Voltage |
| Supply Tolerances | • Max Volt Imbalance<br>• Max Current Imbalance<br>• Nominal Grid Voltage |
| General Setup | • User Language<br>• Motor Name<br>• Local/Remote Mode<br>• Password Edit<br>• Fault / Incoming CB |
| Communication Setup | • RS485 Baudrate<br>• RS485 Parity<br>• Modbus® Slave Address<br>• TCP/IP Parameters<br>– Own IP address<br>– IP subnet mask<br>– Client IP address |

Potentiometer models are setup with a set of six simple-to-use potentiometers and four selector switches as shown below. In addition to this some advanced configuration is also possible via the Modbus® interface.



## 1.1.8 Monitoring Functions of MEsoftstart

A full set of data to help understand the performance of the soft starter and connected motor is accessible from the local touch screen display, the PC application or a host PLC/SCADA Modbus® host link.

**Parameters monitored by MEsoftstart**

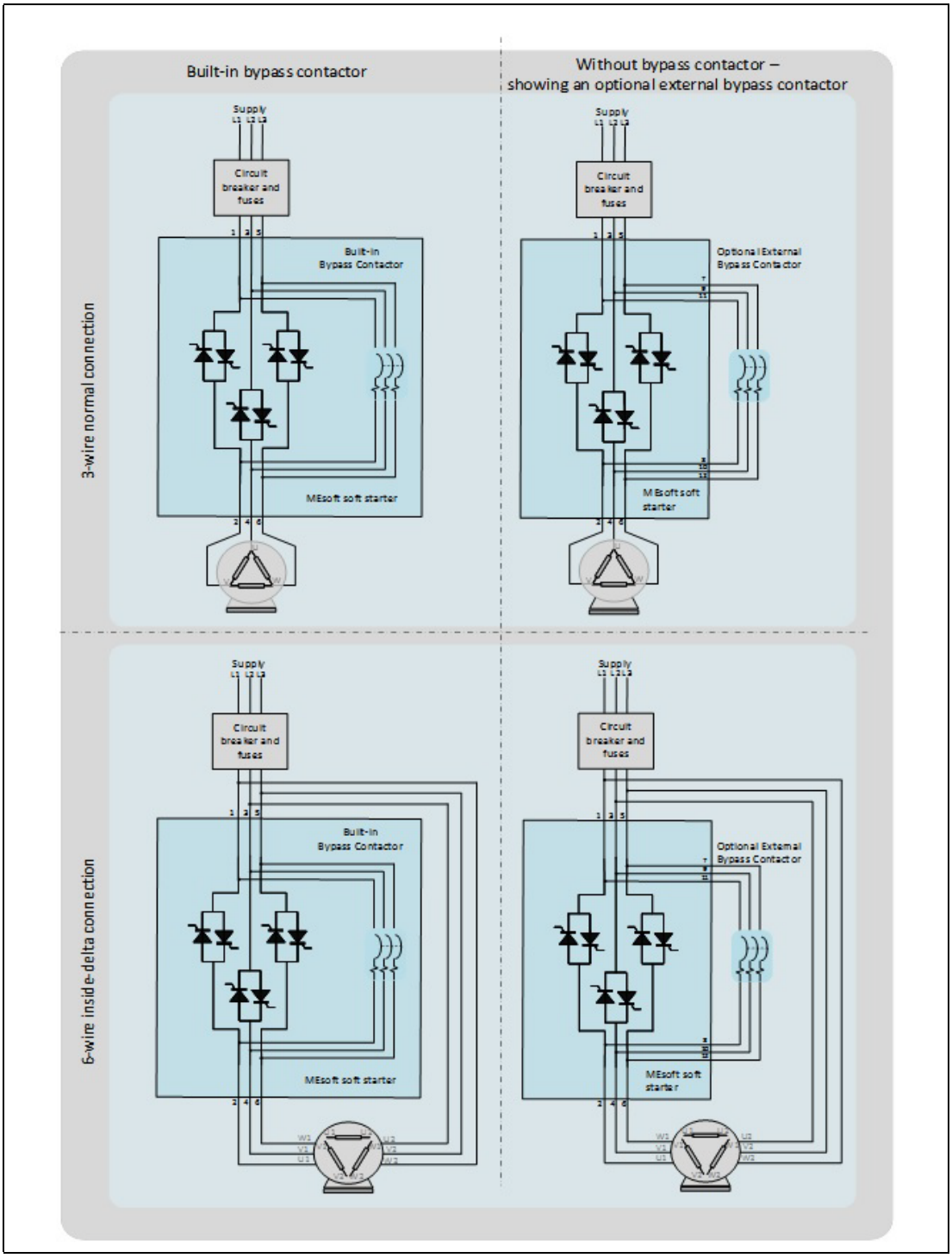
- Current (positive, negative and zero sequence)
- Current demand on all 3 phases
- Current unbalance (% and Amps)
- Line Voltages
- Voltage (L-L, positive, negative and zero sequence)
- Voltage unbalance (% and Volts)
- Motor Voltages
- Energy values①:
  - –kVA and kVAr demand
  - –kW demand
  - –kWh (forward, reverse and net)
  - –kVArh (lead, lag and net)
- Phase control firing angle
- Frequency
- Power factor
- 3 Internal heatsink temperatures
- Internal enclosure temperature
- Motor temperature - with optional external temperature sensor
- Motor history (stops/starts, running hours, protection events and warnings)
- Motor shaft speed (RPM) - with optional RPM sensor and input module

① Based on **MEsoftstart's** regular current and voltage sensors (not for metering or billing purposes)

## 1.1.9 Typical Connection Scheme for MEsoftstart

All **MEsoftstart** soft starters - except the **MEsoftstart/I04** (900A) model - are available with internal bypass contactor. Where no internal contactor is installed, the soft starter is equipped with external terminals for convenient connection of an external bypass contactor. The figure below shows the simple connection schemes available for **MEsoftstart** soft starters, with internal or external bypass contactors (if needed).

Connection schemes for **MEsoftstart** and its controlled motors (normal 3-wire and 6-wire inside-delta motor connection)



# 1.2 Dimensions and Markings

## 1.2.1 MEsoftstart/I00 - 100 A model

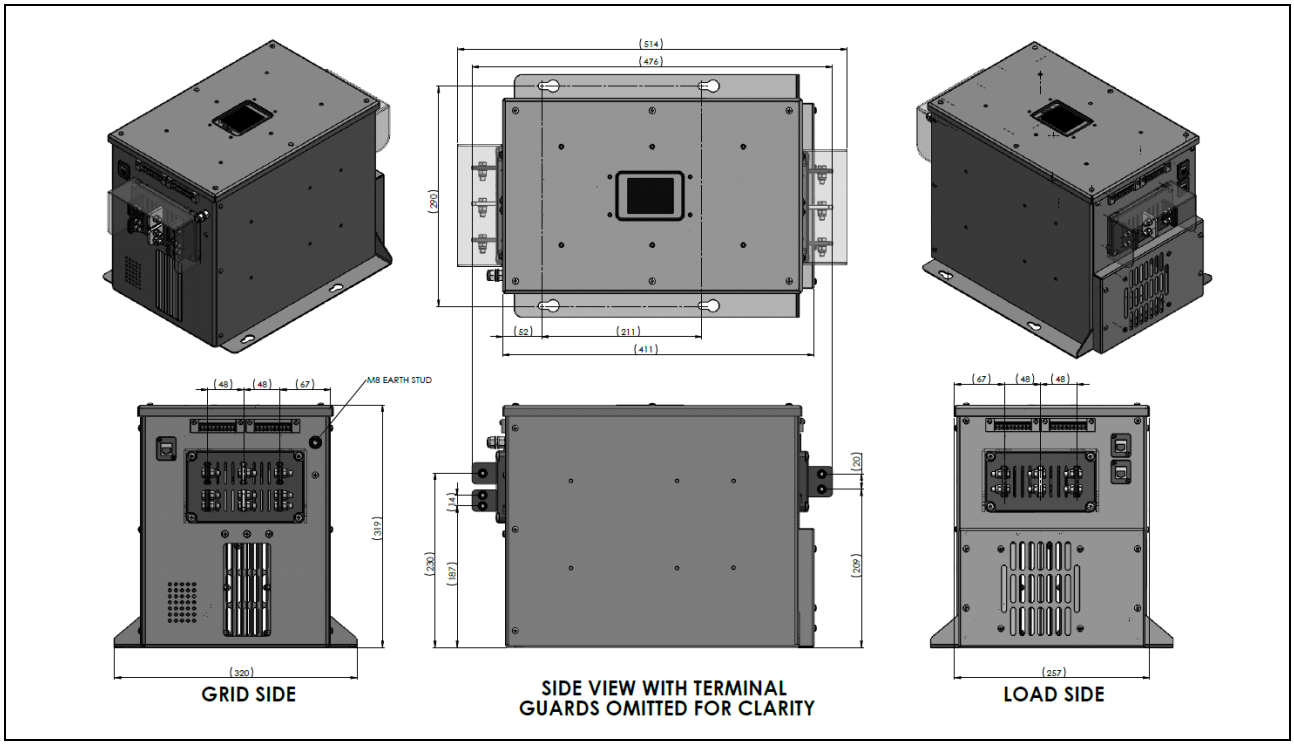



***Fig. 1-1:*** *MEsoftstart/I00 soft starter without bypass contactor*

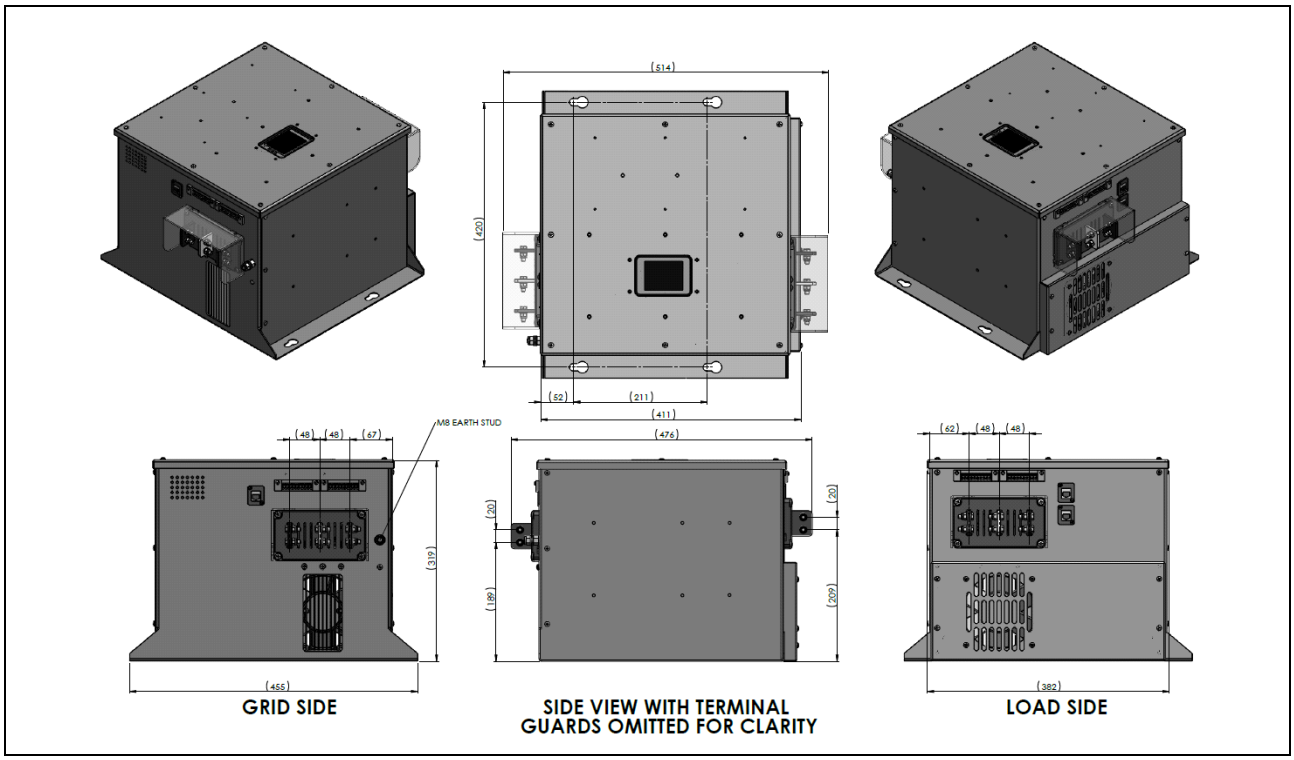



***Fig. 1-2:*** *MEsoftstart/I00 soft starter with internal bypass*

### 1.2.2 MEsoftstart/I01 - 200 A model

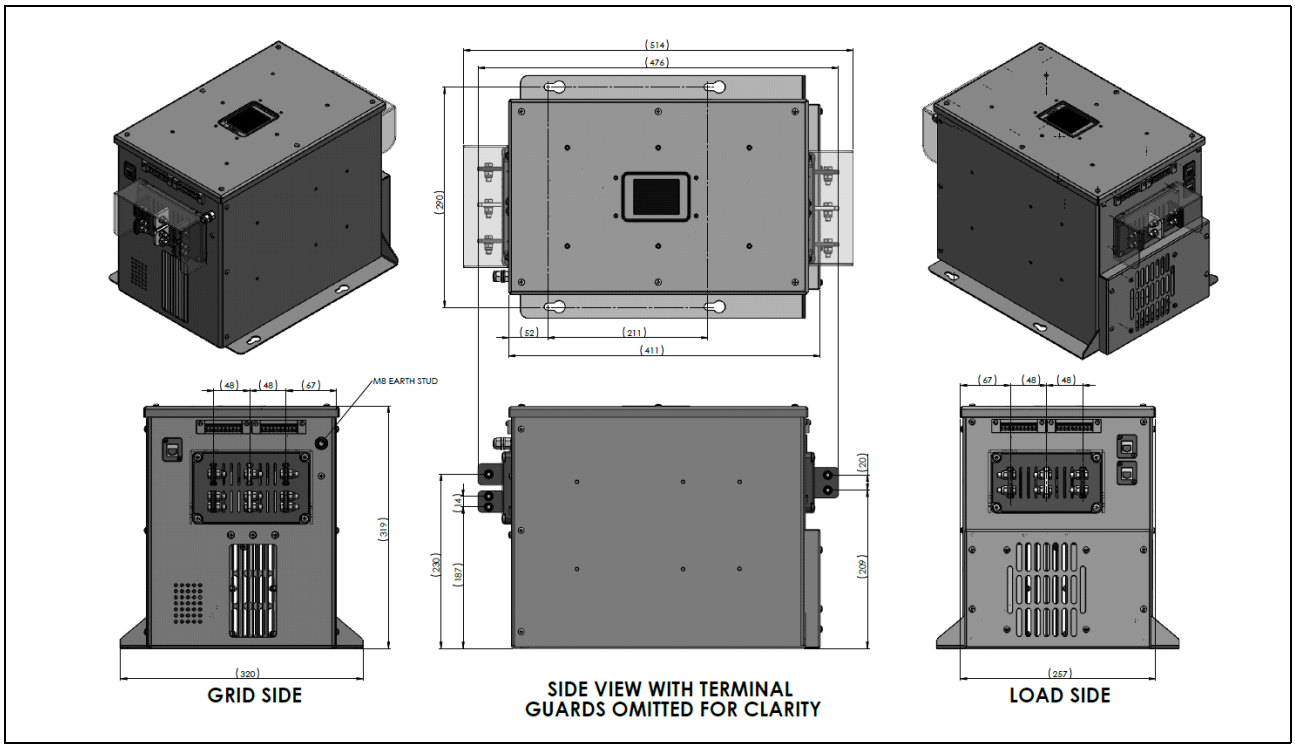



***Fig. 1-3:*** *MEsoftstart/I01 soft starter without bypass contactor*

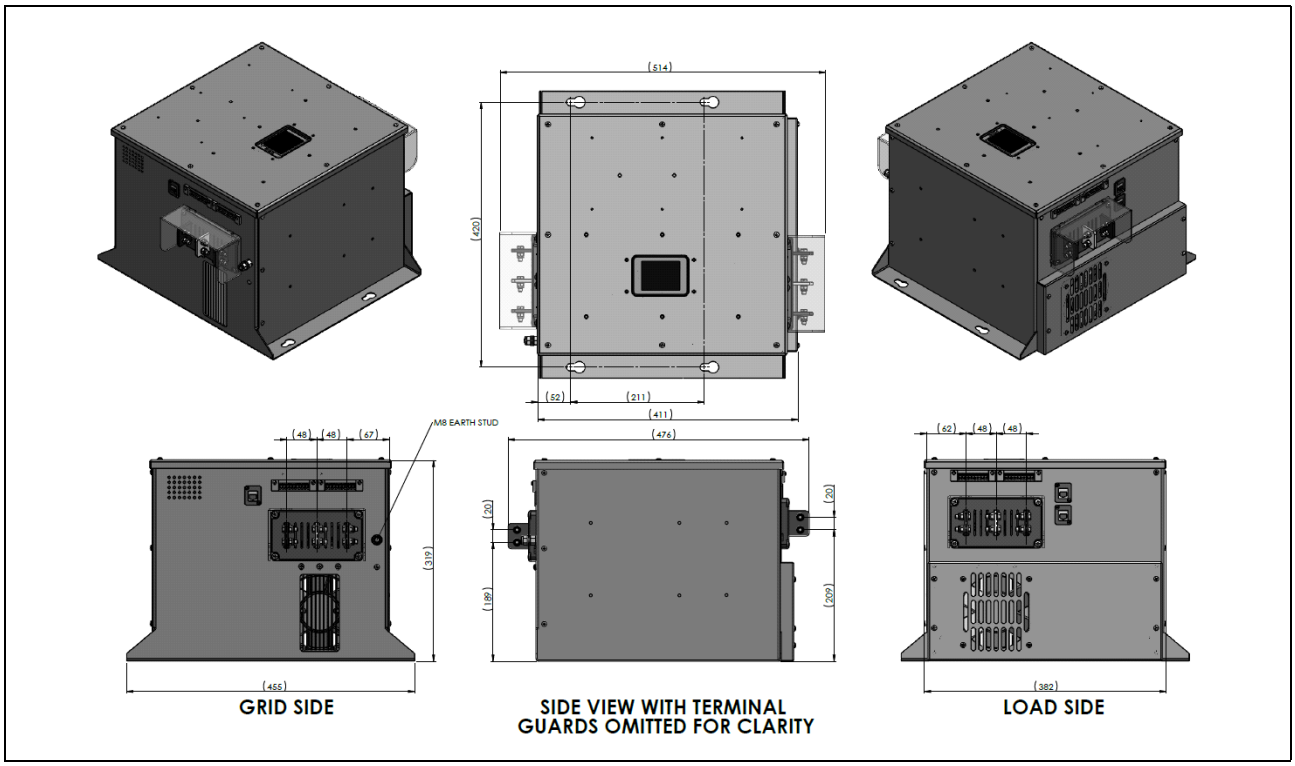



***Fig. 1-4:*** *MEsoftstart/I01 soft starter with internal bypass*

### 1.2.3 MEsoftstart/I02 - 390 A model

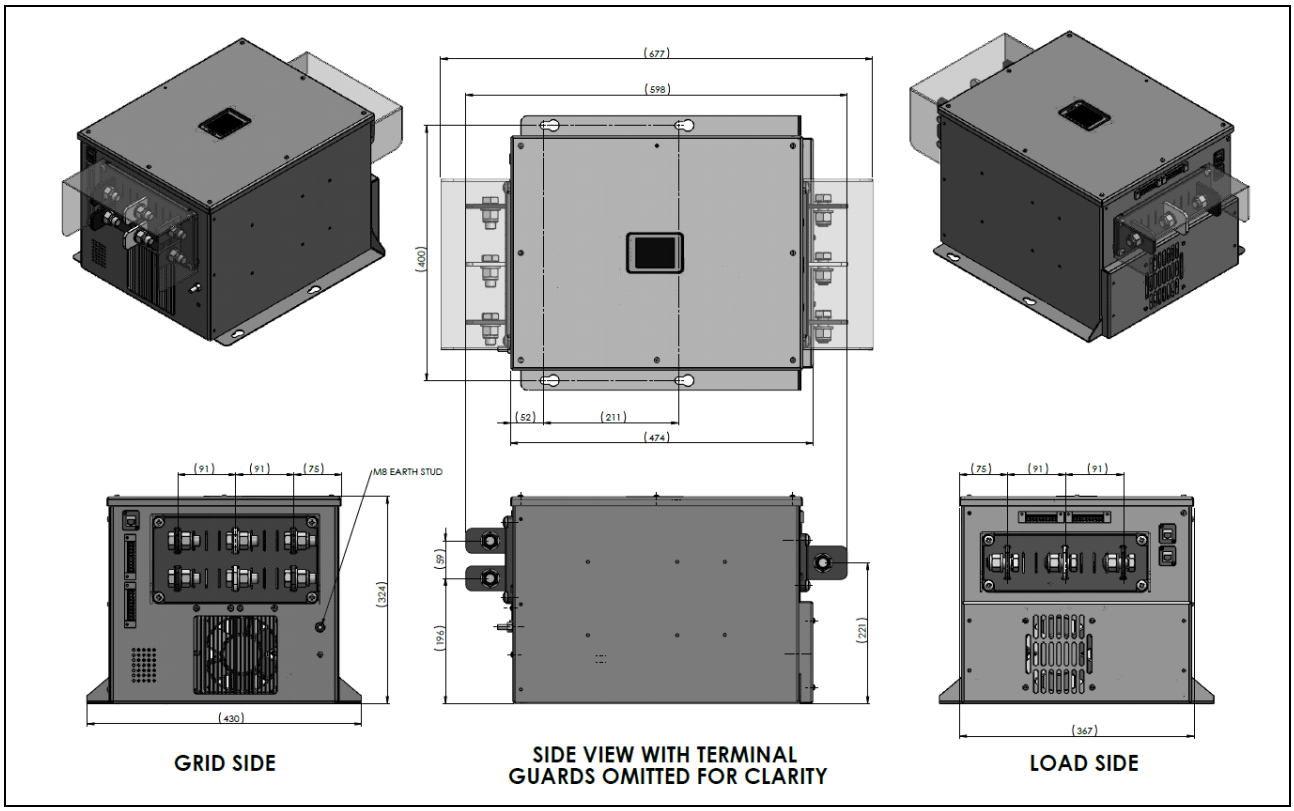



***Fig. 1-5:*** *MEsoftstart/I02 soft starter without bypass contactor*

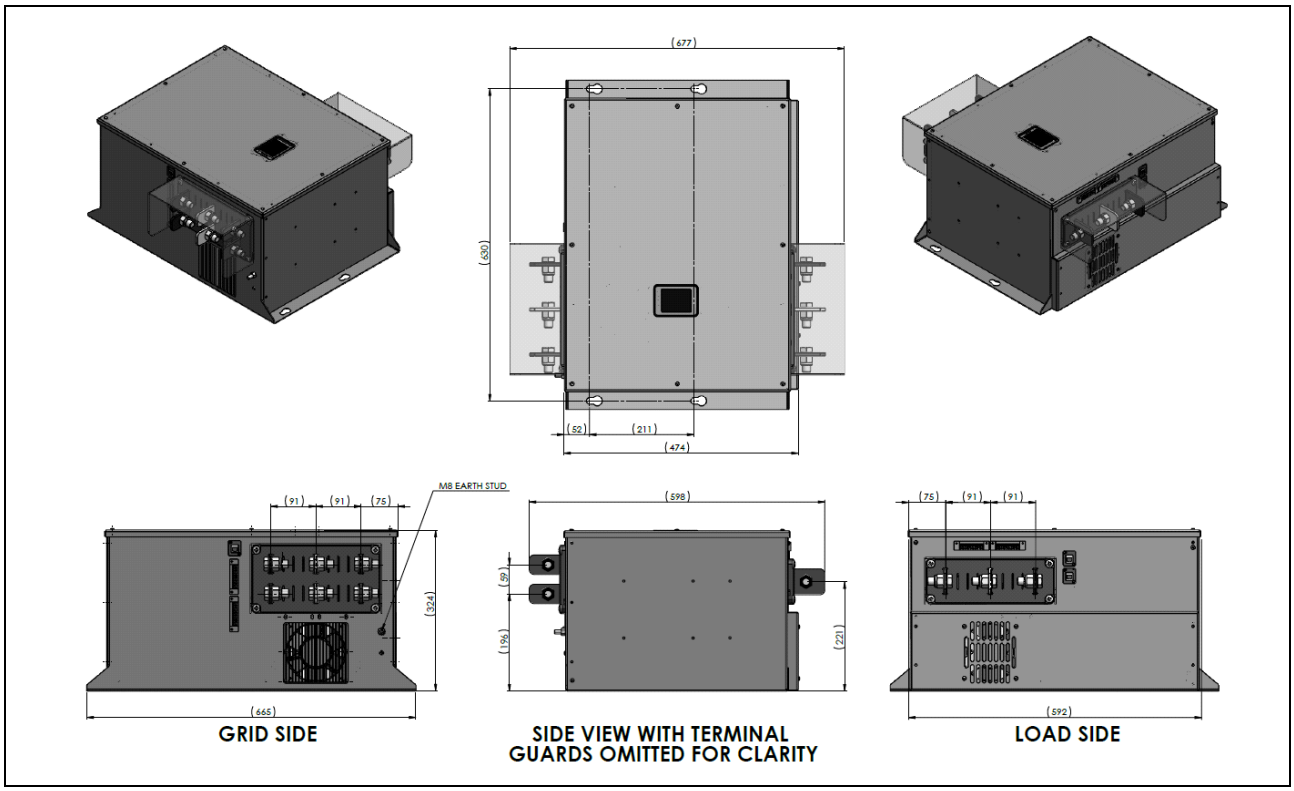



***Fig. 1-6:*** *MEsoftstart/I02 soft starter with internal bypass*

### 1.2.4 MEsoftstart/I03 - 600 A model

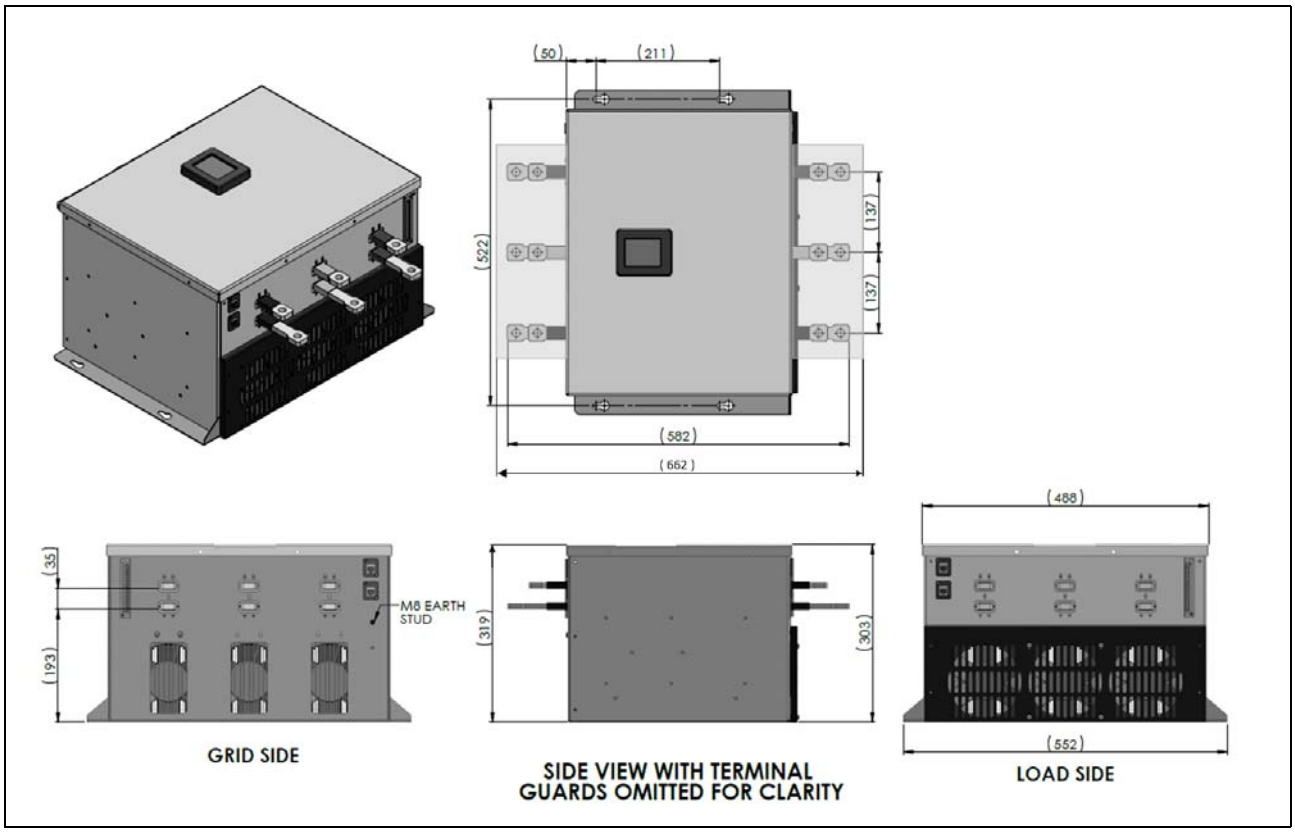



***Fig. 1-7:*** *MEsoftstart/I03 soft starter without bypass contactor*

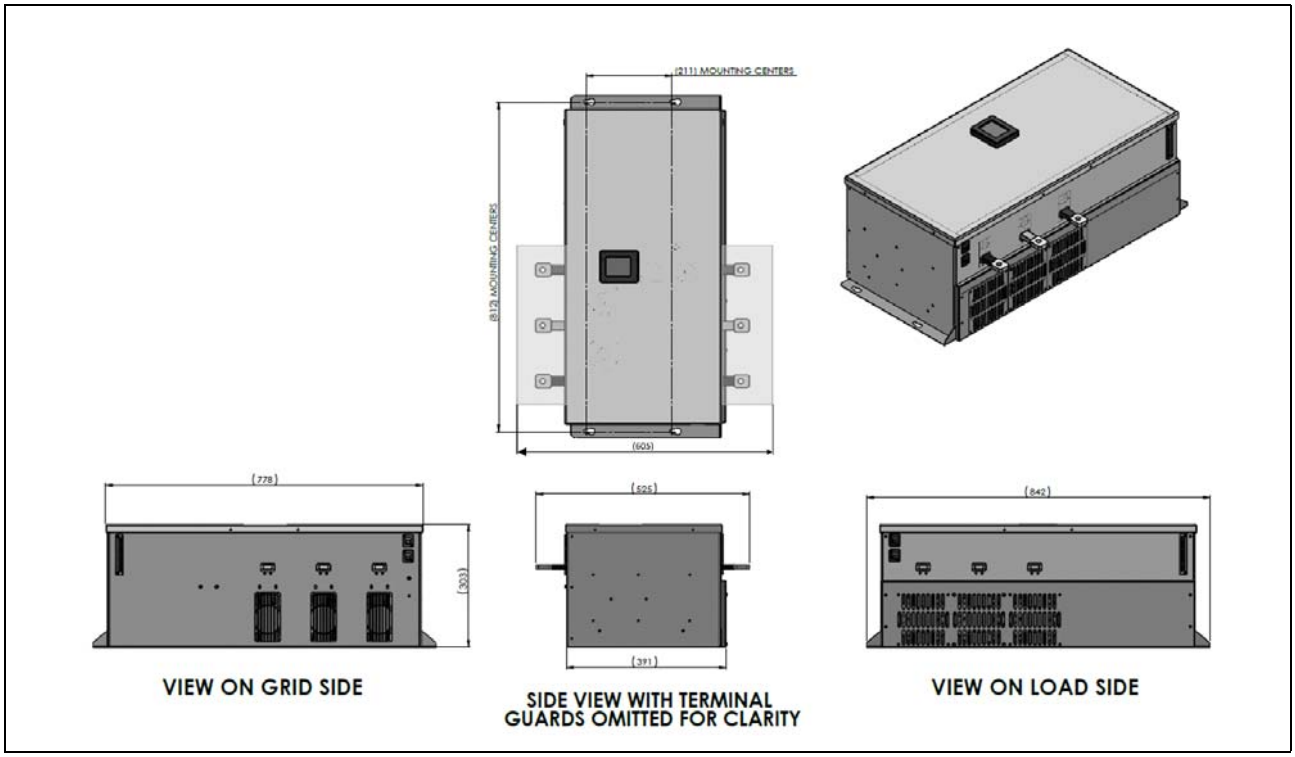



***Fig. 1-8:*** *MEsoftstart/I03 soft starter with internal bypass*

### 1.2.5 MEsoftstart/I04 - 900 A model

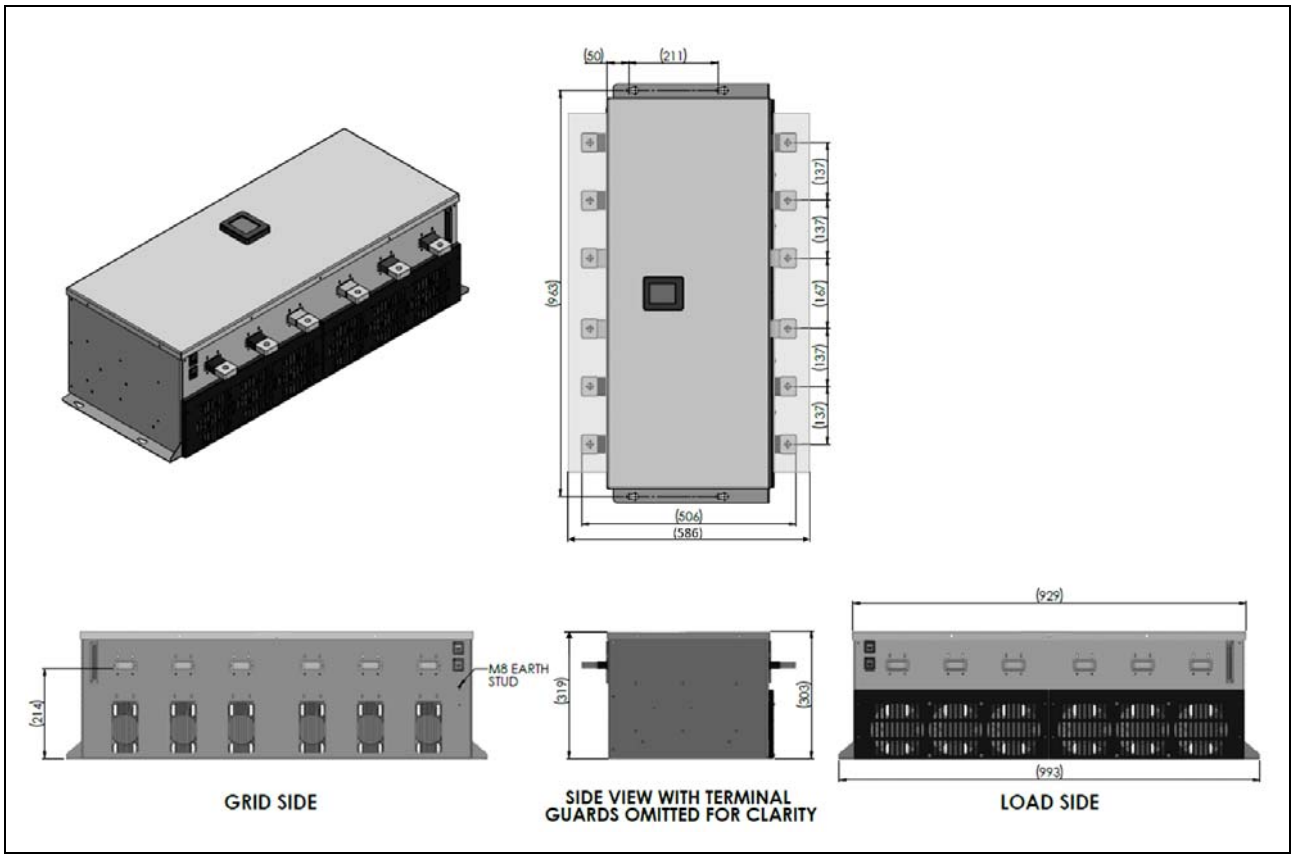



***Fig. 1-9:*** *MEsoftstart/I04 soft starter without bypass contactor*

**NOTE** No internal bypass contactor option is available for the MEsoftstart/I04 model.

# 1.3 Technical Specifications

| Parameter | | Specification | | | | |
|---|---|---|---|---|---|---|
| | | **MEsoft/I00** | **MEsoft/I01** | **MEsoft/I02** | **MEsoft/I03** | **MEsoft/I04** |
| Supply Voltage | | 340–420 V AC, 425–578 V AC, 586–760 V AC | | | | |
| Current Ratings | Max soft starter continuous current @ 50 °C | 100 A S-N125 | 200 A S-N220 | 940 A S-N400 | 600 A S-N600 | 900 A (S-N800) |
| | ME internal bypass contactor model | | | | | |
| | Max starting current – normal duty | 240 A | 480 A | 730 A | 1440 A | 1600 A |
| | Max starting current – heavy duty | 125 A | 250 A | 390 A | 750 A | 1120 A |
| Operating temperature | | -10 °C to +60 °C<br>De-rate all current values at 1.4 % per °C for temperatures >50 °C | | | | |
| Storage temperature | | -30 °C to +70 °C | | | | |
| Relative humidity | | < 85 % non-condensing | | | | |
| Operating altitude | | Up to 1400 m above sea-level. De-rate at 0.7 % per 100 m for altitudes >1400 m | | | | |
| Enclosure protection category | | IP00 | | | | |
| Communication | Standard on all models | Modbus® RTU (RS485, Baud rate: 9600–115200 bps, 8 bits, 1 start bit, 1 stop bit, even parity) | | | | |
| | Standard on Pro models | Modbus® TCP | | | | |
| Digital I/O | | Core models | | Pro models (Full-featured Industrial-range) | | |
| | | 3 relay outputs (5 A, 240 V AC, pot. free): READY, BYPASS, FAULT<br>3 inputs included: RUN/STOP; Auto/Maint.; RESET | | 8 relay outputs included (5 A, 240 V AC, pot. free): READY, RUNNING, TRIP, REVERSING CONTACTOR; BYPASS CONTACTOR; OVERLOAD ALARM; FAULT / LINE VOLTAGE ALARM; TEMPERATURE FAULT<br>3 inputs included: RUN/STOP; Auto/Maint.; RESET<br>Optional Digital I/O expansion via an added PLC module | | |
| Temperature Measurement inputs | | Pt100 or LM35 motor temperature measurement channels | | | | |
| Fault indication | | Flashing LED pattern on Core models,<br>Displayed on the TFT touch screen on Pro models | | | | |
| Mounting | | Chassis mounted (see dimensions) | | | | |
| Module physical data | Size WxHxD [mm] – without bypass | 320x515x319 | 320x515x319 | 430x677x324 | 522x662x320 | 980x586x320 |
| | Size WxHxD [mm] – with bypass | 320x515x319 | 375x515x319 | 665x677x324 | 842x605x319 | — |
| | Weight – without bypass | 12 kg | 18 kg | 22 kg | 40 kg | 60 kg |
| | Weight – with bypass | 16 kg | 25 kg | 49 kg | 67 kg | — |
| | Approx. heat loss (without bypass at maximum rated current) | 450 W | 650 W | 780 kW | 1670 kW | 3410 kW |
| Insulation resistance | | Dielectric breakdown voltage: 2 kV | | | | |
| Connections | **Power:** bolted terminals for cable lugs | Grid / input side: L1, L2, L3 (electrical supply) | | | | |
| | | Motor / output side: T1, T2, T3 (motor) / BT1, BT2, B3 (bypass contactor) | | | | |
| | **Control:** screw terminals | Relay output contacts: Ready, Run, Shunt trip, Alarm | | | | |
| | | Digital inputs (from NC potential-free contacts): Inhibit, Reset, Start | | | | |
| | | Motor temperature input (LM35) | | | | |
| Current sensors | Rated frequency range | 45 Hz–65 Hz | | | | |
| | Quantity | 3 (Hall effect on MEsoft/I00 and I01, CTs on models MEsoft/I02 through I04) | | | | |
| | Measurement dynamic range | 0 %–100 % of soft starter maximum starting current – normal duty | | | | |
| | Thermal rating | Continuous: 2.5 x rated current | | | | |
| | Accuracy | 1.0 % of full scale | | | | |
| | Sampling frequency | 16.6 kHz | | | | |
| Voltage sensor | Rated frequency range | 45 Hz–65 Hz | | | | |
| | Quantity | 3 (direct sense by resistor bridge) | | | | |
| | Maximum rated voltage | 760 V AC | | | | |
| | Thermal rating | 800 V RMS | | | | |
| | Accuracy | 1.0 % of full scale | | | | |
| | Sampling frequency | 16.6 kHz | | | | |
| CE mark compliance | | Low voltage directive (2014/35/EU), EMC directive (2014/30/EU), RoHS 2 (2011/65/EU) | | | | |
| Standards applied (relevant sections) | | IEC/EN 60947-1,<br>IEC/EN 60947-4-2 | | | | |

### 1.3.1 MEsoft ordering information

Once you have decided which MEsoft frame size is suitable for your motor's starting / stopping needs, simply build up the needed part number from the table below, after which complete your selection with the desired accessories as presented here.

### 1.3.2 Main soft starter unit part number

**MEF – I 01 □ – 400 P**

| Device Type | Scope | Model code | Internal Bypass | Supply voltage | Potentiometer setup option |
|---|---|---|---|---|---|
| | I – Industrial | 00 – 100 A | Field <blank> – no bypass | 400–400 V AC | P – Pot. Setup |
| | D – DIN rail ① | 01 – 200 A | B – with internal bypass contactor | 525–525 V AC | Blank – TFT setup |
| | | 02 – 390 A | | 690–690 V AC | |
| | | 03 – 600 A | | | |
| | | 04 – 900 A | | | |

① Please refer to chapter 2.

**Example** ▽ MEF-I01-400P =
Industrial soft starter, 200 A model, no bypass contactor, 400 V supply, with potentiometer setup.

△

### 1.3.3 Accessories part numbers

| Shaft speed (requires optional shaft speed input module) | Part number |
|---|---|
| Shaft speed input module 2 channel | MEF-0-SHAFTIN |
| Shaft speed sensor with mounting bracket and 3 m standard sensor cable | MEF-O-SHAFT3M |
| Shaft speed sensor with mounting bracket and custom length sensor cable | MEF-O-SHAFTXX |
| Shaft speed sensor cable (per metre, specify quantity when ordering) | SHAFT-CABLE |

| Motor temperature (soft starter includes temperature input channel as standard) | Part number |
|---|---|
| Motor temperature sensor with mounting bracket and 3 m standard sensor cable | MEF-O-TEMP3M |
| Motor temperature sensor with mounting bracket and custom length sensor cable | MEF-O-TEMPXX |
| Motor temperature sensor cable (per metre, specify quantity when ordering) | TEMP-CABLE |

| PC Tools (To connect the soft starter to a Laptop) | Part number |
|---|---|
| USB to RS485 Interface (Laptop to **MEsoftstart** converter with cables) | USB-RS485 |

# 2 MEsoftstart/din – DIN Rail Mounted Models

## 2.1 Powerful Low-Voltage Soft Starter in a DIN-Rail Package

When space is limited but you need fast, high-power soft starting …

### 2.1.1 Product Description

MEsoftstart/din-02 and MEsoftstart/din-03 from Mitsubishi Electric Europe are ready-to-use two and three phase intelligent soft starters.

MEsoftstart/din range offers a compact solution for small to medium applications such as pumps, fans, scroll compressors, filler lines, conveyors and more. The operating current is up to 32 A RMS and the starting current is up to 100 A RMS.

Built-in bypass relays are included in all models. Reverse phase rotation protection is included as well as motor protection using motor thermal overload protection curves (Classes 1, 2, 5, 10).

Also included is a pre-start short circuit detection and protection function.

### 2.1.2 Key Features

- General purpose 16 A or 32 A soft starter for 3-phase motors
- Choose from models controlling 2 phases or all 3 phases
- Cost effective solution
- User settings via Modbus®
- Internal or 24 V DC auxiliary supply
- Constant-current-ramp
- Built-in bypass relay
- Motor thermal protection
- Rated operating voltage: 400 V AC RMS 50/60 Hz
- DIN-Rail or panel mountable
- Alarm and Bypass N/O contacts
- Comprehensive protection functions:
  - Undervoltage detection
  - Overvoltage detection
  - Supply Voltage imbalance
  - Supply frequency out of range
  - Motor thermal overload
  - Overcurrent - during starting and running
  - Short circuit while bypassed
  - Internal temperature too high

### 2.1.3 Overview of selectable options

| | |
|---|---|
| **Rated continuous current** | 32 A or 16 A<br>(16 A versions identified by "**L**" in the model suffix) |
| **Controlled phases** | 2 or 3 (model "**02**" and "**03**" respectively) |
| **Communication** | Modbus® or none (factory configured – "**F**" in model suffix) |
| **Control (aux.) voltage** | 24 V DC (external) or 340–440 V AC (self-supplied – "**S**" in model suffix) |

## 2.1.4 MEsoftstart/din-02 vs MEsoftstart/din-03 models

**3-phases controlled**

MEsoftstart/din-03 models are full-featured soft starters that control all three phases – eliminating the possibility of current unbalance during start-up. If a smooth start-up with lowest possible current is required, the MEsoftstart/din-03 model is recommended.

MEsoftstart/din-03 models can be equally well used for both normal three-wire connected motors as well as six-wire inside-delta connected motors – allowing for a wide range of motor sizes.

**2-phases controlled**

MEsoftstart/din-02 models control only two phases while starting the motor. This implies that during ramp-up, the current will be higher in the phase that is not controlled, and lower in the controlled phases. This may cause an imbalance during starting for a short period just after switch-on.

If the application can tolerate small imbalances for around two thirds of the start-up time, then MEsoftstart/din-02 is a good and cost-effective solution.

**NOTE**

The MEsoftstart/din-02LSF model is a low-cost solution for high volume orders and is intended for applications without the need to configure the soft starter, nor needing remote control via the Modbus® interface.

In this case, the configuration is programmed in the factory to user requirements and delivered pre-configured, ready for installation without any further modification. A full-featured MEsoftstart/din-02 model is used for applications requiring most flexible configuration options.

## 2.1.5 Models and functions

| Model | | 02LSF | 02L | 02S | 02 | 03 | 03S | 03L |
|---|---|---|---|---|---|---|---|---|
| No. of controlled phases | | 2 phases (with built-in bypass relays) | | | | 3 phases (with built-in bypass relays) | | |
| Current rating | Continuous | 16 A | | 32 A | | 32 A / 55 A ① | | 16 A |
| | Starting | 50 A | | 100 A | | 100 A / 173 A ② (<1.5 s) | | 50 A |
| Communication | | None ② | Modbus® RTU (RS485 2 x RJ45 ports on housing front) | | | | | |
| Control Voltage | | Not required | 24 V DC | Not required | 24 V DC | 24 V DC | Not required | 24 V DC |
| Mounting | | DIN rail-housing (63 mm wide) with Screw-less – Spring Cage, Tension Clamp Terminals | | | | | | |
| Certification | | CE (VDE, UL pending) | | | | | | |

① With 6-wire inside-delta motor wiring

② Factory pre-configured

### 2.1.6 Internally powered vs 24 V DC models

MEsoftstart/din models with suffix "S" are internally powered. Models without the "S" suffix require a separate 24 V DC supply.

The advantage of the internally powered models is easy installation with no additional power supply. MEsoftstart/din "S" models may be wired to will soft-start the motor as soon as the three phase AC power is applied. Other starting options are: start and stop using a wired pushbutton, or start and stop under PLC control or control via a Modbus® controller. Without an external Modbus® controller, the motor will coast to a stop when the AC power is removed.

The externally supplied models (without the "S" suffix) need a 24 V DC supply. The DC supply should be powered before the AC supply is switched on. This way the CPU can ensure that the bypass relays are open before the AC line voltage is applied.

With the exception of models containing "F" in the model suffix, all soft starter models have a Modbus® interface. This can be used for remote monitoring and control of the soft starter as well as for configuring the soft starter using the MEsoftstart PC App. Note this is possible offline (without having three phase AC supply power connected to the soft starter) by supplying 24 V DC to power the soft starter controller during configuration.

### 2.1.7 Application range of MEsoftstart/din

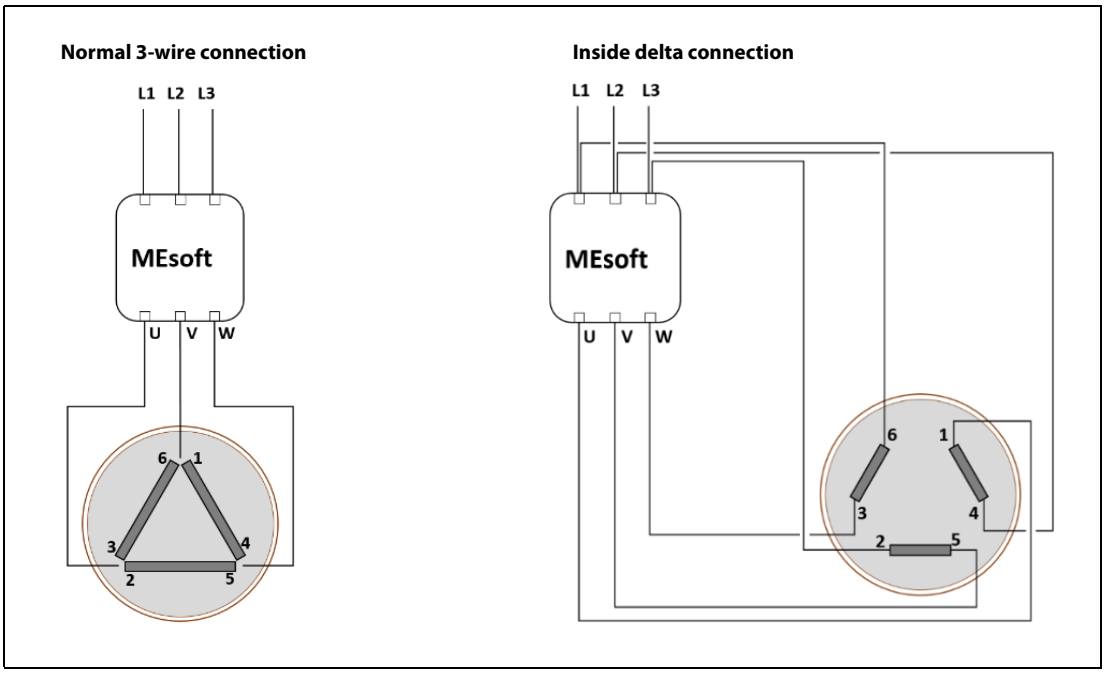
MEsoftstart/din can be applied for both the most commonly encountered motor connection schemes:

- Normal 3-wire motor connection, and
- 6-wire, inside-delta motor connection

In a 6-wire inside-delta connection to a motor, the soft starter switching elements are connected inside the delta and are exposed to only 58 % of the running current of a normal 3-wire connection, and 58 % of the starting current. This implies that a soft starter with a lower current rating may be an appropriate and cost-effective solution.

**NOTE**

Only MEsoftstart/din-03 models support six-wire inside-delta motor connection.
MEsoftstart/din-02 models cannot be connected in an inside-delta circuit.



## 2.1.8 16 $A_{RMS}$ continuous MEsoftstart/din models

MEsoftstart-D02L and MEsoftstart-D03L models are rated at 16 A continuous current and can be used at 50 A starting current. Bypass relays are built-in on all MEsoftstart/din models.

The tables below show the allowable starting current for the listed motor sizes as a percentage of their maximum normal running current at power factor of 0.85.

***Table 1:*** **MEsoftstart-D02L, -D02LF and -D03L 16 A models: guideline for motor sizes**

| Motor Size [kW] | MEsoftstart/din<br>Normal 3-wire circuit | MEsoftstart/din<br>6-wire inside-delta circuit |
|---|---|---|
| 3 | 800 % | |
| 4 | 714 % | |
| 5.5 | 500 % | 800 % |
| 7.5 | 385 % | 625 % |
| 11 | 263 % | 455 % |
| 15 | | 333 % |
| 18.5 | | 263 % |

**NOTE** Only MEsoftstart/din-03 models support six-wire inside-delta motor connection.
MEsoftstart/din-02 models cannot be connected in an inside-delta circuit.

## 2.1.9 32 $A_{RMS}$ continuous MEsoftstart/din models

MEsoftstart-D02, -D02S, -D03 and MEsoftstart-D03S models are rated at 32 A continuous current (when panel mounted) and can be used at starting currents of 100 A (3-wire connected motors) and 170 A (6-wire inside-delta connected motors) for a max. of 1.5 second start-up ramp.

Bypass relays are built-in on all MEsoftstart/din models.

***Table 2:*** **MEsoftstart-D02, -D02S, -D03 and -D03S 32 A models: guideline for motor sizes**

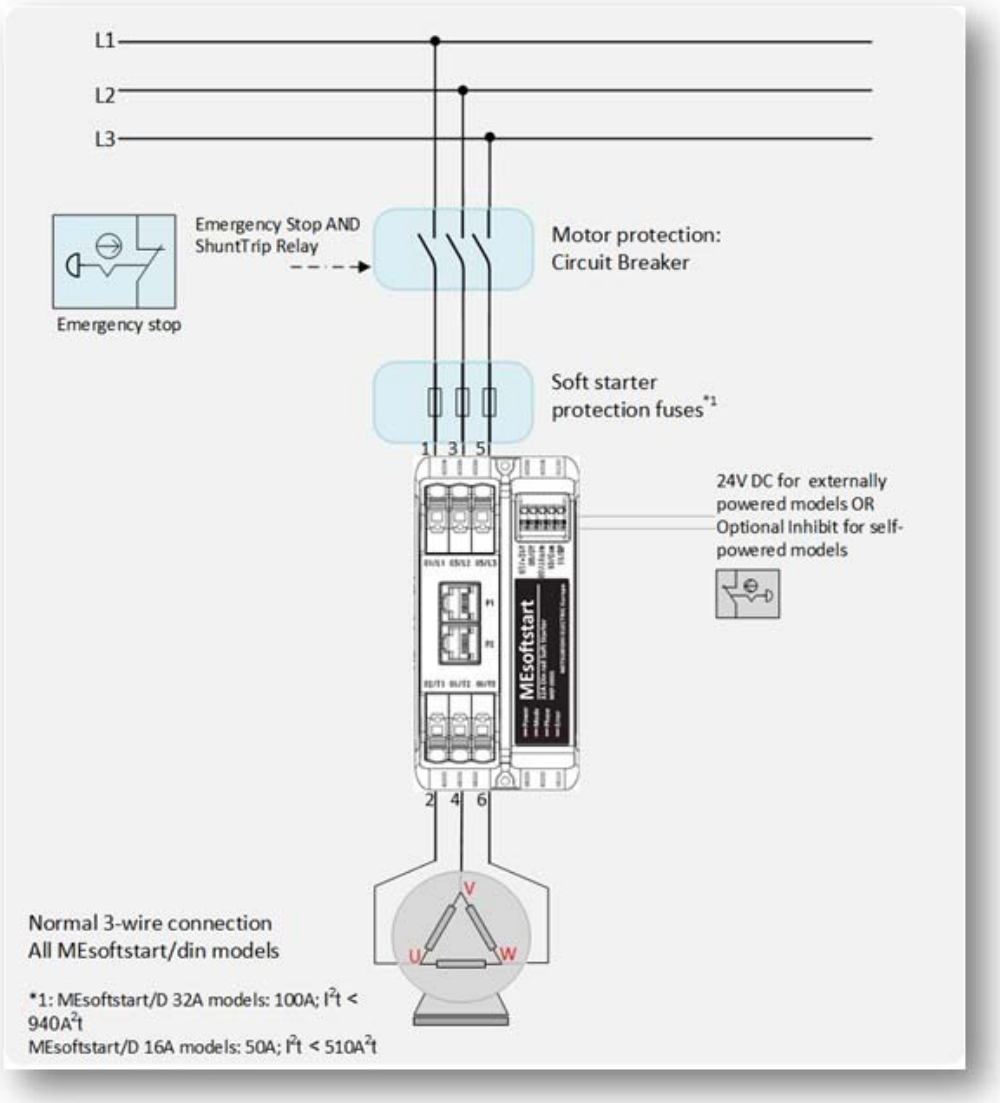
| Motor Size [kW] | MEsoftstart/din<br>Normal 3-wire circuit | MEsoftstart/din<br>6-wire inside-delta circuit |
|---|---|---|
| 4 | 800 % | |
| 5.5 | 800 % | |
| 7.5 | 769 % | |
| 11 | 526 % | 800 % |
| 15 | 385 % | 667 % |
| 18.5 | 313 % | 526 % |
| 22 | | 455 % ① |
| 30 | | 333 % ① |

① Direct panel mounting recommended (Rear side of soft starter in contact with a thermally conductive surface)

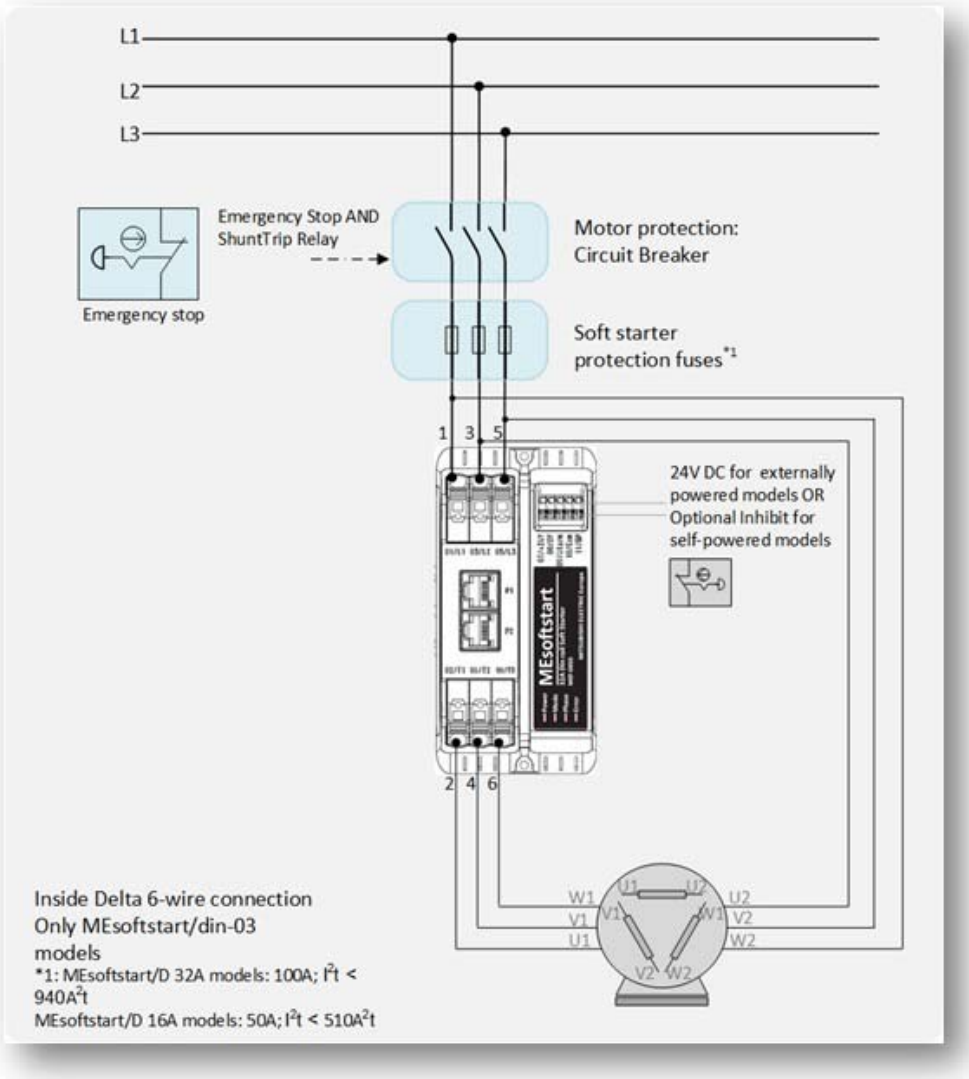
**NOTE** Only MEsoftstart/din-03 models support six-wire inside-delta motor connection.
MEsoftstart/din-02 models cannot be connected in an inside-delta circuit.

## 2.2 MEsoftstart/din is easy to connect

All MEsoftstart/din models can be connected to the motor in a normal 3-wire connection.



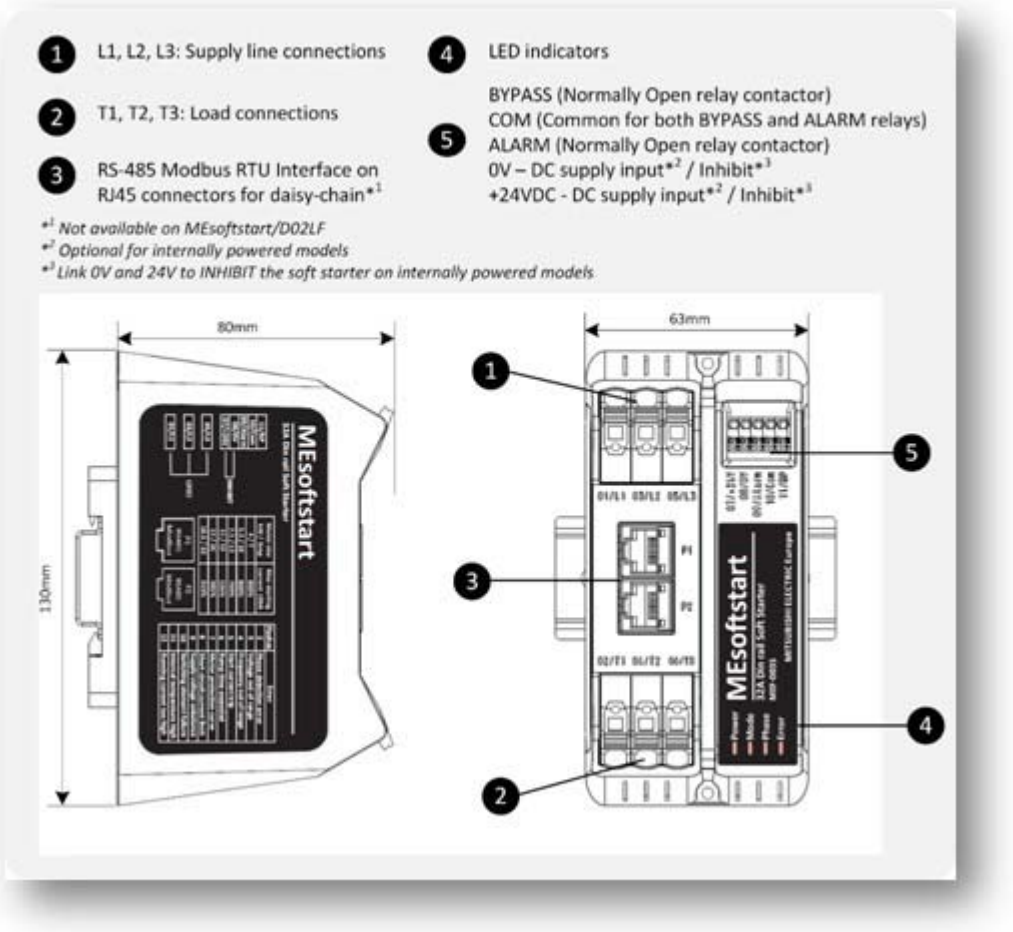
All MEsoftstart/din-03 models (three controlled phases) can also be used in an inside-delta connection.




**NOTE**

Only MEsoftstart/din-03 models support six-wire inside-delta motor connection. MEsoftstart/din-02 models cannot be connected in an inside-delta circuit.

## 2.3 Dimensions and Markings




MEsoftstart/din models are labelled with the soft starter rating, and terminals are marked for easy connection.

## 2.4 Modbus Interface

The MEsoftstart/din range of soft starters (except models with an "F" suffix) features a RS-485 Modus® interface. This can be used for remote monitoring and control of the soft starter as well as for configuring the soft starter with the easy-to-use MEsoftstart PC App.


**NOTE**

Configuration is possible offline (without having three phase AC supply power connected to the soft starter) by supplying 24 V DC to power the soft starter controller during configuration.

Configurable parameters include:

- Motor power [kW] or nameplate current ①
- Start and Stop Ramp duration [seconds]
- Start and End duty cycle [%]
- Maximum start current [% of nameplate current]
- Motor protection class
- Number of starts per hour
- Normal / Inside Delta

① Nameplate current takes precedence if both are entered (if kW is entered, the current is calculated).

The Modbus® interface may also be used to remotely control (e.g. stop and start) the soft starter from a PLC or other control system.

The Modbus® interface is available on two RJ45 connectors on the front panel that allow ready daisy-chain connection to the next Modbus® RTU down the line.

# 2.5 Specifications

## 2.5.1 Environmental Specifications

| Item | MEsoftstart | | | | | | |
|---|---|---|---|---|---|---|---|
| | -D02 | -D02L | -D02LF | -D02S | -D03 | -D03L | -D03S |
| Operating temperature | -20 °C to +60 °C | | | | | | |
| Storage temperature | -40 °C to +80 °C | | | | | | |
| Relative humidity | <95 % non-condensing @ 40 °C | | | | | | |
| Pollution degree | 2 | | | | | | |
| Degree of protection | IP20 (EN/IEC 60529) | | | | | | |
| Installation category | III | | | | | | |
| Installation altitude | Up to 1400 m above sea-level. De-rate at 0.7 % per 100 m for altitudes >1400 m | | | | | | |

## 2.5.2 Supply Specifications

| Item | | MEsoftstart | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | -D02 | -D02L | -D02LF | -D02S | -D03 | -D03L | -D03S |
| Operational voltage L1 – L3 | | 340–440 V AC RMS 50/60 Hz | | | | | | |
| Supply current at standby | | <30 mA | | | | | | |
| Blocking voltage | | 1200 Vpk | | | | | | |
| Rated AC frequency | | 50/60 Hz +/-10 % | | | | | | |
| Control Voltage | | 24 V DC ±10 % | Internal supply | | | 24 V DC ±10 % | Internal supply | |
| Control Input Current | | <100 mA in idle state | 30 mA AC | | | <100 mA in idle state | 30 mA AC | |
| Input to Output response time | | <100 ms | | | | | | |
| Rated insulation voltage | | 5000 V AC | | | | | | |
| Dielectric withstand voltage | Supply to enclosure | 2.5 kV RMS | | | | | | |
| Rated Insulation Voltage | | 500 V AC | | | | | | |
| Dielectric Strength | Dielectric withstand voltage | 2 kV RMS | | | | | | |
| | Rated impulse withstand voltage | 4 kV RMS | | | | | | |

## 2.5.3 General Specifications

| Item | | MEsoftstart | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | -D02 | -D02L | -D02LF | -D02S | -D03 | -D03L | -D03S |
| Starting method ① | | Constant current ramp | | | | | | |
| Ramp-up time ① | | 1–10 sec | | | | | | |
| Ramp-down time ① | | 0–10 sec (stop-ramp- only an option when under Modbus® control) | | | | | | |
| Initial Torque ① | | Factory set via the maximum starting current, default value 200 % | | | | | | |
| Undervoltage/Over-voltage protection | Recovery from undervoltage | 320 A AC | | | | | | |
| | Recovery from overvoltage | 480 A AC | | | | | | |
| Status Feedback | | LEDs Power, Mode, Phase and Error (For a detailed description, please refer to section 2.6.1) | | | | | | |
| Communication | | Modbus® RTU ② (RS485 with 2x RJ45 ports on housing front for easy daisy-chaining), Baud rate: 9600–115200 bps (default: 115200 bps), 1 start bit, 1 stop bit, even parity)<br>Default address: 1 | | | | | | |

① Configurable via Modbus® on all except MEsoftstart-D02L model.

② Except on models with suffix containing "F" (e.g. MEsoftstart-D02LSF)

## 2.5.4 Output Specifications

| Item | | MEsoftstart | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | -D02 | -D02L | -D02LF | -D02S | -D03 | -D03L | -D03S |
| IEC rated operational current IEC60947-4-2 (AC-53b) @ 50 °C | DIN-Rail mounting | 20 A RMS | 16 A RMS | 16 A RMS | 20 A RMS | 20 A RMS | 16 A RMS | 20 A RMS |
| | Panel mounting (on a temperature conductive surface) | 32 A RMS | 16 A RMS | 16 A RMS | 32 A RMS | 32 A RMS | 16 A RMS | 32 A RMS |
| IEC rated operational current IEC60947-4-2 (AC-53b) above 50 °C | | De-rate all current values at 5 % per °C for temperatures >50 °C | | | | | | |
| Minimum load current | | 0.1 A RMS | | | | | | |
| Max. number starts/hour @ 50 °C | | Default: 60 (no more than once every minute), but adjustable between 12 and 120. | | | | | | |
| Minimum time between stop and start | | 1 sec | | | | | | |
| Minimum time between starts | | 30 sec | | | | | | |

## 2.5.5 Electromagnetic Compatibility

| Item | | MEsoftstart | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | -D02 | -D02L | -D02LF | -D02S | -D03 | -D03L | -D03S |
| Immunity | | IEC/EN 60947-4-2 | | | | | | |
| Electrostatic discharge (ESD) | Immunity | EC/EN 61000-4-2 | | | | | | |
| | Air discharge: 8 kV | Performance Criteria 2 | | | | | | |
| | Contact: 4 kV | | | | | | | |
| Electrical Fast Transient (Burst) | Immunity | IEC/EN 61000-4-4 | | | | | | |
| | Output: 2 kV | Performance Criteria 2 | | | | | | |
| | Input: 1 kV | | | | | | | |
| | Electrical surge immunity | IEC/EN61000-4-5 | | | | | | |
| | Output, line to line, 1 kV | Performance Criteria 2 | | | | | | |
| | Output, line to earth, 2 kV | | | | | | | |
| | Input, line to line, 1 kV | | | | | | | |
| | Input, line to earth, 2 kV | | | | | | | |
| Conducted Radio Frequency | Immunity | IEC/EN 61000-4-6 | | | | | | |
| | 10V/m, 0.15–80 MHz | Performance Criteria 1 | | | | | | |
| | Emission | IEC/EN 60947-4-2 | | | | | | |
| Radio interference field emissions (radiated) | | CISPR 11 IEC/EN 55011<br>Class A (Industrial) | | | | | | |
| Radio interference voltage emissions (conducted) | | CISPR 11 IEC/EN 55011<br>Class A (Industrial) | | | | | | |
| Voltage dips & interruptions | 0 % Ue & Uc, 5000 ms | Performance Criteria 2 | | | | | | |
| | 40 % Ue & Uc, 100/1000 ms | Performance Criteria 1/ Performance Criteria 2 | | | | | | |
| | 70 % Ue & Uc, 10 ms | Performance Criteria 1 | | | | | | |
| Rated radio frequency | Immunity | IEC/EN 61000-4-3 | | | | | | |
| | 3 V/m, 0.15– 80 MHz | Performance Criteria 1 | | | | | | |
| Harmonics | | IEC/EN 61000-3-2 | | | | | | |
| Flicker | | IEC/EN 61000-3-3 | | | | | | |

# 2.6 Operation of MEsoftstart/din Soft Starters

Complete operating instructions can be found in the MEsoftstart/din User Manual. The easy-to-interpret LED flash patterns described below show the operating, monitoring and fault indication functions of the device.

## 2.6.1 LED Indicators

### Power LED


When 24 V power is present on the board the Power LED will flash at a frequency of 0.5 Hz.

When Modbus® RTU communication has been established and the board is under Modbus® control this LED will flash at 1 Hz.

| LED state | CPU state | Description |
|---|---|---|
| LED off | No power | No power on the CPU card in the soft starter |
| 0.5 Hz Flashing | Power present; Modbus® not detected | The power is present on the CPU card. CPU is not detecting any Modbus® communication. |
| 1 Hz Flashing | Power present; Modbus® in control | The power is present on the CPU card. Soft starter is under Modbus® control. Use the Modbus® commands to start and stop the motor. |

### Mode LED


This LED provides feedback regarding the mode of the software. The Mode LED state can be interpreted whenever the Power LED is flashing. The interpretation of the Mode LED state is described in the table below.

| LED state | CPU state | Description |
|---|---|---|
| LED off | Idle mode | This is the state when 24 V DC is present, but prior to application of the AC voltage, or if AC voltage is present but the soft starter is under Modbus® control: prior to a START command. |
| 5 Hz Flashing | Ramp mode | When AC voltage is applied and the ramp-up or ramp-down is in progress, the LED flashes. |
| LED on | Bypassed mode | Ramp-up has been completed, and bypass relays have been engaged. The motor should be running. The bypass relays are closed. |
| 1 Hz Flashing | Delay mode | After a Modbus® STOP command, or when operating from 24 V DC supply, after the AC voltage is removed: Soft starter is implementing the restart delay time. |
| 0.5 Hz Flashing | Error mode | An error condition was detected. All switching elements are turned off awaiting further operator intervention. See error LED for more details. |

### Phase LED


This LED indicates the detected phase of the applied 3-phase power. The configured phase orientation must be clockwise. The interpretation of the Phase LED state is described in the table below.

| LED state | CPU state | Description |
|---|---|---|
| LED off | Unknown phase | This occurs before AC power is applied and during phase synchronisation immediately after application of AC power. |
| LED on | Correct phase | The phase rotation is correct. |
| 0.5 Hz Flashing | Phase error | An incorrect phase rotation is detected. |

### Error-LED


The Error LED provides feedback on error conditions. When no error condition is detected, this LED will be off.

When an error is detected the LED will repeat a sequence of flashes specific to the error condition. The sequence will consist of a number of 0.5 s on and 0.5 s off pulses, followed by an off-period of 1.5 s. The table below describes the number of flashes for each error condition.

| Flashes | CPU state | Description |
|---|---|---|
| 2 | Motor underload | A motor underload condition (MULC) is detected, with the motor current falling below a configured percentage e.g. 10 % of the rated motor current for a period of more than 60 seconds. |
| 3 | Supply voltage out of range | Over- or undervoltage condition detected on the input voltage lines or a brown-out condition was detected. |
| 4 | Supply frequency out of range | Detected frequency differs from expected frequency by more than 5 %. |
| 5 | Over current during start | Current exceeds current limit of 100 A (for 32 A model) or 50 A (for 16 A model) during ramp-up. |
| 6 | Ramp time exceeded | Total ramp-up time exceeds 10 s. This includes the periods where ramping is halted due to the soft current limit being reached. |
| 7 | Motor overload | The motor protection curve for the configured protection class was violated during bypassed operation. |
| 8 | Short circuit while running | Current exceeds the short circuit current limit of 100 A (for 32 A model) or 50 A (for 16 A model) while bypassed. |
| 9 | Supply voltage imbalance | Voltage levels on input lines differ from each other with more than 20 %. |
| 10 | Switching element failure | Current flow detected in a line where the TRIAC and relay are switched off, or no current flow when TRIAC / bypass relay should be conducting. |
| 11 | Internal temperature high | Internal temperature of the soft starter is high and caused the soft starter to trip. |
| 12 | Running current too high | The motor running current exceeds the soft starter continuous rated current. |

## 2.7 Ordering information

**MEF–D0 2 □ S □**

| Standard MEsoftstart/din product prefix | Phases controlled | Current rating | Aux. supply | Configuration |
|---|---|---|---|---|
| | 2 – 2 phases | L – 16 A (low current) | S – Self supplied | F – Factory configured |
| | 3 – 3 phases | <blank> – 32 A (default current rating) | <blank> – Ext. 24 V DC (default) | <blank> – User (default) |

Model selected in the above example: **MEF-D02S**.

## HEADQUARTERS

Mitsubishi Electric Europe B.V. **EUROPE**
Mitsubishi-Electric-Platz 1
**D-40882 Ratingen**
Phone: +49 (0)2102 / 486-0
Fax: +49 (0)2102 / 486-1120

Mitsubishi Electric Europe B.V. **CZECH REP.**
Pekařská 621/7
**CZ-155 00 Praha 5**
Phone: +420 255 719 200
Fax: +420 251 551 471

Mitsubishi Electric Europe B.V. **FRANCE**
25, Boulevard des Bouvets
**F-92741 Nanterre Cedex**
Phone: +33 (0)1 / 55 68 55 68
Fax: +33 (0)1 / 55 68 57 57

Mitsubishi Electric Europe B.V. **IRELAND**
Westgate Business Park, Ballymount
**IRL-Dublin 24**
Phone: +353 (0)1 4198800
Fax: +353 (0)1 4198890

Mitsubishi Electric Europe B.V. **ITALY**
Viale Colleoni 7 Palazzo Sirio
**I-20864 Agrate Brianza (MB)**
Phone: +39 039 / 60 53 1
Fax: +39 039 / 60 53 312

Mitsubishi Electric Europe B.V. **NETHERLANDS**
Nijverheidsweg 23C
**NL-3641RP Mijdrecht**
Phone: +31 (0) 297 250 350

Mitsubishi Electric Europe B.V. **POLAND**
ul. Krakowska 48
**PL-32-083 Balice**
Phone: +48 (0) 12 347 65 00
Fax: +48 (0) 12 630 47 01

Mitsubishi Electric (Russia) LLC **RUSSIA**
2 bld. 1, Letnikovskaya st.
**RU-115114 Moscow**
Phone: +7 495 / 721 2070
Fax: +7 495 / 721 2071

Mitsubishi Electric Europe B.V. **SPAIN**
Carretera de Rubí 76-80 Apdo. 420
**E-08190 Sant Cugat del Vallés (Barcelona)**
Phone: +34 (0) 93 / 5653131
Fax: +34 (0) 93 / 5891579

Mitsubishi Electric Europe B.V. (Scandinavia) **SWEDEN**
Hedvig Möllers gata 6,
**SE- 223 55 Lund**
Phone: +46 (0) 8 625 10 00

Mitsubishi Electric Turkey Elektrik Ürünleri A.Ş. **TURKEY**
Fabrika Otomasyonu Merkezi
Şerifali Mahallesi Kale Sokak No:41
**TR-34775 Ümraniye-İSTANBUL**
Phone: +90 (216) 969 25 00
Fax: +90 (216) / 661 44 47

Mitsubishi Electric Europe B.V. **UK**
Travellers Lane
**UK-Hatfield, Herts. AL10 8XB**
Phone: +44 (0)1707 / 28 87 80
Fax: +44 (0)1707 / 27 86 95

Mitsubishi Electric Corporation **JAPAN**
Tokyo Building 2-7-3
Marunouchi, Chiyoda-ku
**Tokyo 100-8310**
Phone: +81 (3) 3218-2111
Fax: +81 (3) 3218-2185

Mitsubishi Electric Automation, Inc. **USA**
500 Corporate Woods Parkway
**Vernon Hills, IL 60061**
Phone: +1 (847) 478-2100
Fax: +1 (847) 478-0328

## EUROPEAN REPRESENTATIVES

GEVA **AUSTRIA**
Wiener Straße 89
**A-2500 Baden**
Phone: +43 (0)2252 / 85 55 20
Fax: +43 (0)2252 / 488 60

000 TECHNIKON **BELARUS**
Prospect Nezavisimosti 177-9
**BY-220125 Minsk**
Phone: +375 (0)17 / 393 1177
Fax: +375 (0)17 / 393 0081

INEA RBT d.o.o. **BOSNIA AND HERZEGOVINA**
Stegne 11
**SI-1000 Ljubljana**
Phone: +386 (0)1/ 513 8116
Fax: +386 (0)1/ 513 8170

AKHNATON **BULGARIA**
4, Andrei Ljapchev Blvd., PO Box 21
**BG-1756 Sofia**
Phone: +359 (0)2 / 817 6000
Fax: +359 (0)2 / 97 44 06 1

INEA CR **CROATIA**
Losinjska 4 a
**HR-10000 Zagreb**
Phone: +385 (0)1 / 36 940 - 01/ -02/ -03
Fax: +385 (0)1 / 36 940 - 03

AutoCont C. S. S.R.O. **CZECH REPUBLIC**
Kafkova 1853/3
**CZ-702 00 Ostrava 2**
Phone: +420 595 691 150
Fax: +420 595 691 199

HANS FØLSGAARD A/S **DENMARK**
Theilgaards Torv 1
**DK-4600 Køge**
Phone: +45 4320 8600
Fax: +45 4396 8855

Electrobit OÜ **ESTONIA**
Pärnu mnt. 160i
**EST-11317, Tallinn**
Phone: +372 6518 140

UTU Automation Oy **FINLAND**
Peltotie 37i
**FIN-28400 Ulvila**
Phone: +358 (0)207 / 463 500
Fax: +358 207 / 463 501

UTECO A.B.E.E. **GREECE**
5, Mavrogenous Str.
**GR-18542 Piraeus**
Phone: +30 (0)211 / 1206-900
Fax: +30 (0)211 / 1206-999

MELTRADE Kft. **HUNGARY**
Fertő utca 14.
**HU-1107 Budapest**
Phone: +36 (0)1 / 431-9726
Fax: +36 (0)1 / 431-9727

OAK Integrator Products SIA **LATVIA**
Ritausmas iela 23
**LV-1058 Riga**
Phone: +371 67842280

Automatikos Centras, UAB **LITHUANIA**
Neries krantiné 14A-101
**LT-48397 Kaunas**
Phone: +370 37 262707
Fax: +370 37 455605

ALFATRADE Ltd. **MALTA**
99, Paola Hill
**Malta-Paola PLA 1702**
Phone: +356 (0)21 / 697 816
Fax: +356 (0)21 / 697 817

## EUROPEAN REPRESENTATIVES

INTEHSIS SRL **MOLDOVA**
bld. Traian 23/1
**MD-2060 Kishinev**
Phone: +373 (0)22 / 66 4242
Fax: +373 (0)22 / 66 4280

Fonseca S.A. **PORTUGAL**
R. João Francisco do Casal 87/89
**PT-3801-997 Aveiro, Esgueira**
Phone: +351 (0)234 / 303 900
Fax: +351 (0)234 / 303 910

SIRIUS TRADING & SERVICES SRL **ROMANIA**
Aleea Lacul Morii Nr. 3
**RO-060841 Bucuresti, Sector 6**
Phone: +40 (0)21 / 430 40 06
Fax: +40 (0)21 / 430 40 02

INEA SR d.o.o. **SERBIA**
Ul. Karadjordjeva 12/217
**SER-11300 Smederevo**
Phone: +381 69 172 27 25

SIMAP SK (Západné Slovensko) **SLOVAKIA**
Dolné Pažite 603/97
**SK-911 06 Trenčín**
Phone: +421 (0)32 743 04 72
Fax: +421 (0)32 743 75 20

INEA RBT d.o.o. **SLOVENIA**
Stegne 11
**SI-1000 Ljubljana**
Phone: +386 (0)1 / 513 8116
Fax: +386 (0)1 / 513 8170

OMNI RAY AG **SWITZERLAND**
Im Schörli 5
**CH-8600 Dübendorf**
Phone: +41 (0)44 / 802 28 80
Fax: +41 (0)44 / 802 28 28

CSC- AUTOMATION Ltd. **UKRAINE**
4 B, Yevhena Sverstyuka Str.
**UA-02002 Kiev**
Phone: +380 (0)44 / 494 33 44
Fax: +380 (0)44 / 494-33-66

## EURASIAN REPRESENTATIVES

TOO Kazpromavtomatika **KAZAKHSTAN**
UL. ZHAMBYLA 28,
**KAZ-100017 Karaganda**
Phone: +7 7212 / 50 10 00
Fax: +7 7212 / 50 11 50

## MIDDLE EAST REPRESENTATIVE

EIM Energy **EGYPT**
3 Roxy Square
**ET-11341 Heliopolis, Cairo**
Phone: +202 24552559
Fax: +202 245266116

SHERF Motion Techn. Ltd. **ISRAEL**
Rehov Hamerkava 19
**IL-58851 Holon**
Phone: +972 (0)3 / 559 54 62
Fax: +972 (0)3 / 556 01 82

CEG LIBAN **LEBANON**
Cebaco Center/Block A Autostrade DORA
**Lebanon-Beirut**
Phone: +961 (0)1 / 240 445
Fax: +961 (0)1 / 240 193

## AFRICAN REPRESENTATIVE

ADROIT TECHNOLOGIES **SOUTH AFRICA**
20 Waterford Office Park 189 Witkoppen Road
**ZA-Fourways**
Phone: + 27 (0)11 / 658 8100
Fax: + 27 (0)11 / 658 8101