SOLCON™ USA

MOTOR CONTROL IS OUR NATURE

HRVS-DN

Medium Voltage Soft Starter

rugged, durable performance

Ratings: 2.3 kV to 15kV

accepted worldwide

www.solconusa.com

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Overview

Why Soft Starters?

Three-phase AC induction motors are commonly used in a wide variety of industrial applications. Due to their starting characteristics, in many cases these motors cannot be connected directly to the power supply system. When starting direct on line (DOL) the motor can see a very high surge current reaching up to 6 times the rated motor current. This excessive current puts stress on the supply system and the switchgear. Also, when starting direct on line, a very high peak torque can occur stressing the driven motor, the mechanical system including auxiliary power transmission parts (V-belt, gears, etc.).

There are several methods for reducing the damaging effects of this excessive starting current. Conventional methods include reactors and autotransformers. But these methods only allow the voltage to be reduced in steps whereas a soft starter provides step-free acceleration of the drive system by continuously increasing the voltage over a selected period of time. This approach to starting minimizes the effect of high inrush current on the supply system, the motor and the driven load.

Soft starters provide the following benefits:

- Reduced starting current eliminates voltage drops and dips of the supply network
- Smoother acceleration of loads eliminates process or product damage
- Extended lifetime of all mechanical components, e.g. eliminating gearbox damage and resulting in less maintenance and downtime
- Extended motor life
- Reduced maintenance and operating costs

HRVS-DN Class E2 Soft Starter in NEMA12 enclosure
Figure 1

HRVS-DN - Setting a New Standard

The HRVS-DN is an innovative product that provides a flexible, low cost alternative to fixed speed (DOL) starting.

Designed for use with standard medium voltage three-phase squirrel cage induction motors, this high-performance digital soft starter ensures smooth acceleration and deceleration.

HRVS-DN is available in all standard internationally recognized medium voltage ratings: 2.3 kV, 3.3 kV, 4.16 kV, 6 kV and 6.6 kV, 10kV, 11kV, 13.8kV and 15kV.

The standard current output range capability is from 60 - 2700A (200 kW to 50 MW).

HRVS-DN is designed and built to meet international standards including:

- IEC
- EN
- DIN VDE
- NEMA
- UL/CUL
- IEEE

The HRVS-DN soft starters are manufactured to the highest quality level. The entire design, production and delivery process has been certified DIN ISO 9001.2000.

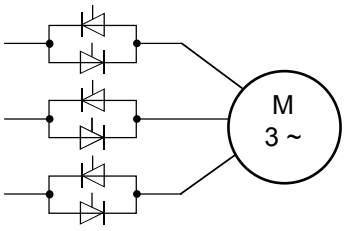
The enclosed versions of the HRVS-DN are provided as ready-to-connect enclosed type units (shown in Figures 1 and 2) or - for OEMs and qualified integrators only - chassis type OEM kits are available for building the unit into custom enclosures or other relevant equipment.

HRVS-DN in NEMA 3R special “outdoor” enclosure for harsh environments
Figure 2

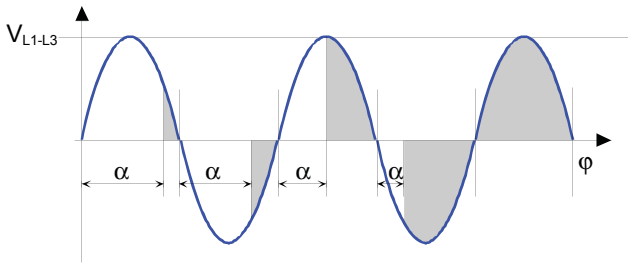
Overview

How Soft Starters Work

By using thyristors (SCRs) in a phase angle control mode, reduced voltage control can be achieved. Phase control makes it possible to gradually increase the motor terminal voltage from an initial set point up to the system supply voltage level. The related starting current and the starting torque can be optimally adjusted to the motor/load conditions.



Basic diagram of HRVS-DN medium voltage soft starter



Phase control of the line voltage using semiconductor (SCR) devices

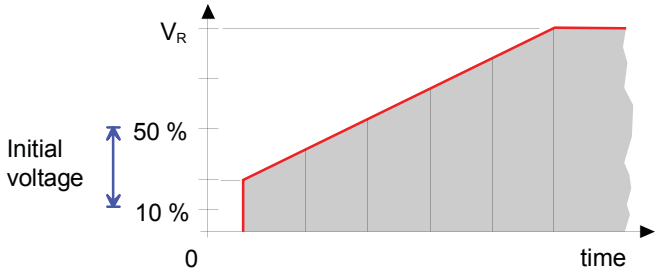
In addition, the Solcon HRVS-DN soft starters provide the “soft stopping” function as a standard feature. Similar to the reduced voltage start, upon a stop command the motor voltage is gradually decreased over time until the motor load stops. Abrupt stopping is avoided, a particular advantage in pumping applications to prevent the damaging effects of water hammer and on conveyor belts where the load may be damaged by an abrupt stop.

Starting and Stopping Characteristics

Initial voltage

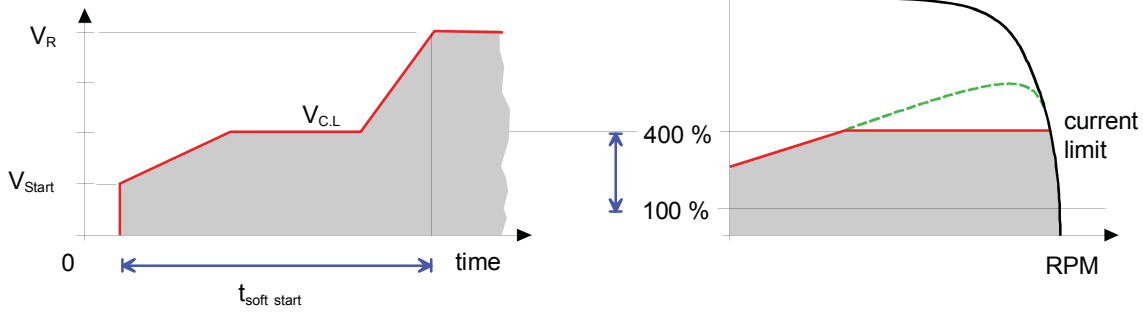
Determines motor’s initial starting torque (the torque is directly proportional to the square of the voltage). Adjustable from 10 – 50% of nominal motor voltage V_R (with option to extend to 80 % V_R).

This adjustment also determines the inrush current and mechanical shock. A setting which is too high may cause excessive initial mechanical shock and high inrush current (even if current limit is set low, as the initial voltage setting overrides current limit setting). A setting which is too low may result in prolonged start time before the motor shaft will begin to turn. Ideally, the motor shaft should slowly begin to turn immediately after a start signal is initiated.



Current limit

Determines highest allowable current during starting. Adjustable from 100 – 400% of nominal motor current I_R (with option to extend to 500 % I_R).



Too high a current limit setting will cause excessive current draw from the mains and faster acceleration. A setting which is too low may prevent the motor from completing the acceleration process and reaching full speed. In general this setting should be set to a value that is high enough to prevent the motor from stalling.

Note: Current limit is not operational during run mode or during soft stop.

Overview

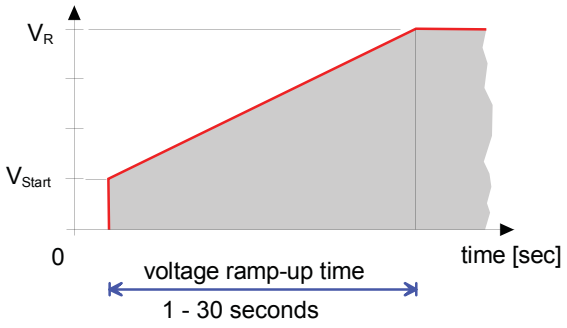
Acceleration (ramp-up time)

Determines the motor's voltage ramp-up time, from initial votage setting to full voltage. Adjustable from 1 - 30 seconds (with option to extend to 90 sec).

It is recommended that the acceleration ramp time be set to the minimum acceptable value (approx. 5 sec).

Notes:

- Since current limit overrides acceleration time, when current limit is set low starting time will be longer than the preset acceleration time.
- When the motor reaches full speed before nominal voltage is reached, acceleration time setting is overridden and voltage ramps up quickly to full voltage.



Deceleration - soft stop (ramp-down time)

Used for controlled deceleration of high friction loads.

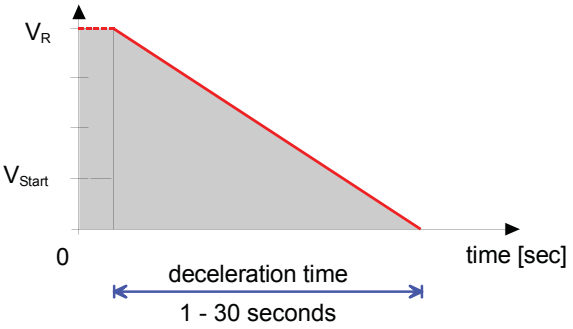
Determines motor's voltage ramp-down time. Adjustable from 1 - 30 seconds (with option to extend to 90 sec.)

Notes:

When soft starter is supplied with a by-pass contactor (standard):

- soft stop initiation opens the "end of acceleration" contact,
- tripping opens the by-pass contactor.

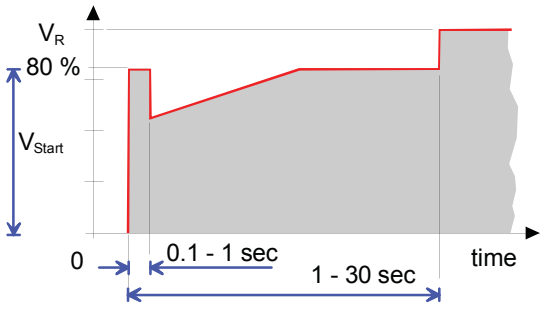
Load will then be transferred to the HRVS-DN and voltage begins ramping down.



Pulse start (kick start)

Intended to start high friction loads requiring high starting torque for a short period of time. A pulse of 80% V_R (without current limit) is initiated to break the load free. Pulse time is adjustable from 0.1 - 1 seconds.

After this pulse, the voltage ramps down to the initial voltage setting before ramping up again to full voltage based on the starting parameters settings.

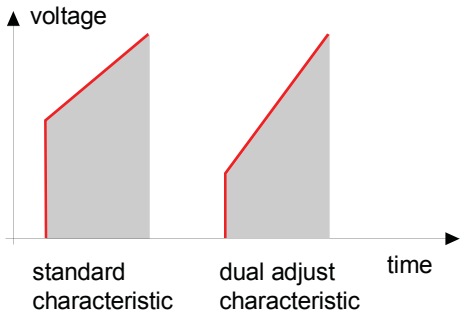


Dual adjustment

The HRVS-DN allows two start/stop characteristics for varying load applications (example: starting and stopping different motors or loads that vary due to changing ambient conditions).

Dual adjustment parameters are:

Special starting mode:	Diesel generator supply*
Initial voltage:	10 - 50 % (80 %) VR
Current limit:	100 - 400 % of motor FLA setting
Motor FLA:	50 - 100 % starter Full Load Current (FLC) setting
Acceleration time:	1 - 30 sec (with option to extend to 90 sec)
Deceleration time:	1 - 30 sec (with option to extend to 90 sec)



***Diesel generator starting**

When starting from older Diesel generator sets (especially those equipped with low cost voltage regulators) both voltage and frequency are unstable causing irregular firing of the SCRs. The HRVS-DN is equipped with a special program which overcomes this voltage and frequency instability.

Overview

Pump control - Start curves

Induction motors produce peak torque of up to 3 times the rated torque during the starting process. In some pump applications, this peak may cause high pressure in the pipes.

Standard soft starters drastically reduce the starting torque however peak torque still remains high, causing high acceleration torque and rapid acceleration toward the end of starting process. Peak torque and acceleration torque must be reduced in order to extend the acceleration time.

The HRVS-DN provides 6 different starting curves for voltage ramp-up to reduce peak torque and extend acceleration time:

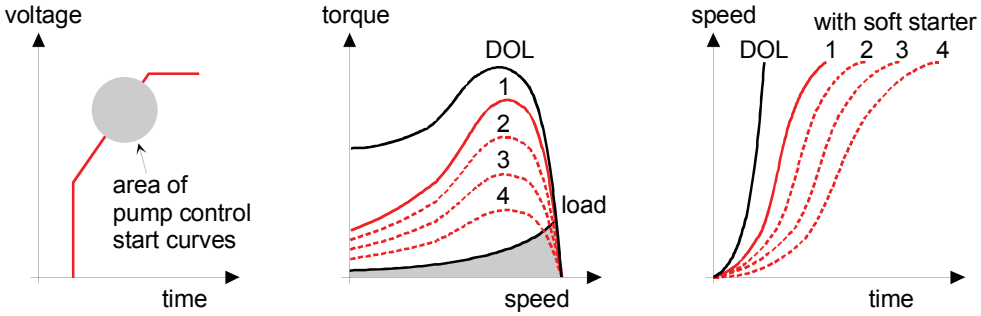
Curve 0: Basic curve for commissioning.

Curve 1: Standard curve (default). The most stable and suitable curve for the motor; prevents prolonged starting time and motor overheating.

Curves 2, 3, 4: During acceleration (before reaching peak torque) the pump control program automatically controls the voltage ramp-up, reducing peak torque.

Curve 5: Torque curve

By default, the process should always be started using curve 1. If toward end of acceleration the peak torque is considered to be too high (pressure is too high) starting curves 2, 3 or 4 can be selected instead.



Pump control - Stop curves

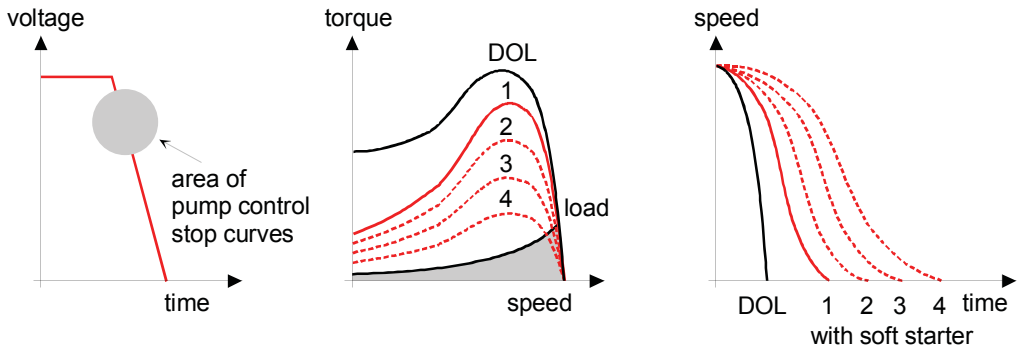
When stopping a pump motor using a starter that does not have the soft stop feature, motor torque will immediately fall below the load torque. This causes abrupt stalling creating the water hammer phenomenon which can be very damaging to the pump, the pipes, valves, etc. A soft starter with the “Soft stop” feature will smoothly decreases the motor speed to zero, eliminating this phenomenon.

The HRVS-DN incorporates 4 different stopping curves for special voltage ramp-down (decel control) preventing the motor from stalling and eliminating water hammer. The pump control stop curves can also be set so the final torque stops the motor when the valve closes.

Curve 1: Standard default curve. The voltage is linearly reduced from nominal to zero.

Curves 2, 3, 4: According to the actual pump characteristic the soft stop behavior can be selected out of four preset curves.

By default, always try using curve 1 first. If the motor stalls quickly instead of slowly decreasing its speed, try stop curve 2. If this still is not satisfactory, try curves 3 or 4.



FAQs

Question	Answer
Can an HRVS-DN soft starter be used to start a heavy-duty load or a load with a high moment of inertia if the motor will not start direct-on-line (DOL)?	**Yes** **But we need certain data to calculate the minimal starting conditions. Contact technical support for assistance.**
Can an HRVS-DN soft starter be connected to the medium-voltage bus without using a load break disconnect switch?	**Yes** The HRVS-DN can be provided without a load break switch (with inline and bypass contactors only). A fused load-break disconnect switch at the medium-voltage feeder is sufficient. The fuses are only used as cable protection and protection against catastrophic failure. The motor protection relay is usually included in the circuit breaker or the soft-starter can be equipped with a comprehensive motor protection relay (MPS3000 or equivalent) If an existing circuit-breaker is used, this can remain closed or switches in the no-current condition (exception: under fault conditions)
Can an HRVS-DN soft-starter also be used to start synchronous motors?	**Yes** A non-excited synchronous motor behaves essentially the same as a squirrel-cage induction motor. If the motor has reached the rated speed in a non-excited condition (rated slip in induction motor operation), the excitation system (which can be supplied by Solcon) is switched-in and the motor then pulls into synchronized mode
Is the HRVS-DN soft-starter available in an explosion-proof version?	**Yes with certification (EEx-D)[ia]I** Solcon is the only MV soft starter manufacturer in the world to offer this certification.
Can the HRVS-DN soft-starter be used to start several different motors or can one HRVS-DN soft starter be used to start more than one motor?	**Yes** Two parameter settings can be programmed using the "Dual Adjustment" function. This means that two different motor types can be started. However, there may be little difference in the actual motor output. Several identical motors can be started. However, due to the higher thermal load, a larger soft-starter (always equipped with a fan), must be used. One (or several) additional cabinets with vacuum contactors can be provided for sequential starting of multiple motors.
When is a tachometer (shaft encoder) required to be used with the HRVS-DN soft-starter?	A tachometer is generally not required for standard applications, only for special cases: • Soft stopping with shutdown (power-off) at a specific speed • Starting and/or stopping with an adjustable speed profile • If it has to be accurately determined when the motor has reached full speed
Is the HRVS-DN soft-starter also available in an outdoor versions ?	**Yes** NEMA 3R, 4, 4X (IP67)
Is the HRVS-DN soft-starter designed to meet industry sector-specific and local standards	**Yes** IEC, NEMA UL / CUL DNV and ABS or similar upon request
Is it possible to use HRVS-DN soft-starters on synchronous or slip ring motors?	**Yes** Unless the slip ring motor was originally specified due to especially high starting torque requirements. Under these circumstances, a soft-starter cannot be used !
Can you use the HRVS-DN soft starter with any manufacturer's motor?	**Yes** In especially critical cases, increased pulsating torques can be observed with some motor designs. The non-sinusoidal current and voltage waveform of the soft starter does not represent a risk.
Can HRVS-DN soft starters operate at high altitudes (i.e. locations 4000m above sea level)?	**Yes** But the nominal voltage and current have to be reduced based on the derating table (please refer to page 10) and the starting frequency (number of starts per unit time) may need to be reduced
Can the HRVS-DN soft-starter be operated with supply voltages which are not listed in the table (intermediate values)?	**Yes** In this case, the next higher voltage class should be selected, and the actual supply voltage specified when ordering.
Can an HRVS-DN soft starter be operated into a step-up transformer?	**Yes** But why should a step-up transformer be used when Solcon offers the HRVS-DN in ratings up to 15kV?
Does an HRVS-DN soft-starter generate harmonics which are fed back into the supply?	**Yes** But only for a very brief period of time until the bypass contactor closes (low level harmonies only)

Product Design

Standard HRVS-DN Soft Starter Design

The Standard HRVS-DN soft starter is supplied in a NEMA12 enclosure ready to be installed and operated. Optional NEMA 3R and other enclosure types are also available.

The design includes:

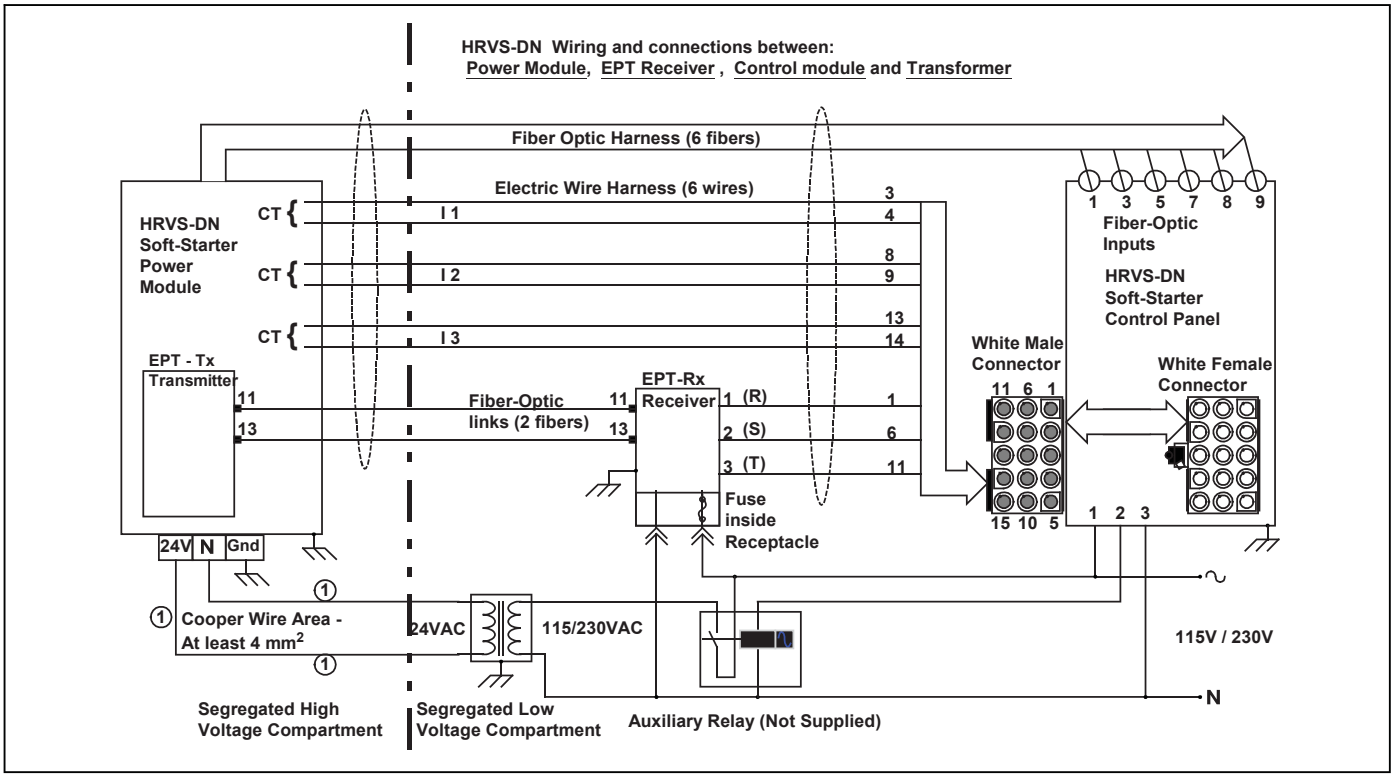
- Digital soft starter, high-voltage and low-voltage compartment
- Disconnect switch (load break - fault make switch with fuses), line and bypass vacuum contactors.
- Low voltage controls
- Modbus RS485 communications

  Optional communication protocols are available including Profibus, DeviceNet and others allowing for:

  - Remote control (start, stop, etc.)
  - Remote supervision

High voltage compartment

- The advanced digital firing system connects the low voltage control to the high voltage section via fiber optics.
- A service-friendly design allows the individual phase modules to be changed (if required) in a minimal amount of time.
- The high-voltage compartment is fully segregated from the low-voltage compartment for safe operation.



Basic diagram of HRVS-DN Control Circuitry

Product Design

Low-voltage compartment

The HRVS-DN has a separate, front accessible low voltage compartment mounted in the front door of the enclosure which includes the following components:

- Soft starter digital control module
- Soft Starter / Off / Bypass selector switch
- Hand / Off / Auto selector switch
- Start / Stop pushbuttons
- Emergency Stop button
- Pilot lights: run (red), stop (green), fault (amber)
- Motor protection relay (optional)

All control components in the LV-compartment are wired to a customer terminal strip. The low voltage compartment door can be opened without switching off the starter.

Door Mounted Pilot Devices

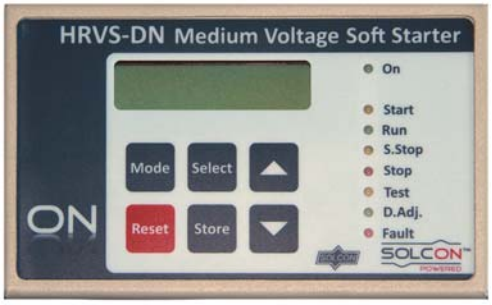
Operator panel / Digital Control Module (DCU)

The HRVS-DN digital control module (DCU) is easy to read, easy to navigate and easy to program. Critical parameters are factory pre-set but parameters can easily be changed via the user-friendly control module.

HRVS-DN Digital Control Module located in isolated low voltage compartment

Includes:

- LCD-display:
  - Two lines, 16 characters each, back light
  - Selectable languages: English, German, French, Spanish (Chinese and Russian optional)
- 8 LEDs for quick status display
- 6 keys, menu driven software, default parameters



HRVS-DN LCD display/keypad operator

Product Design

MV Chassis Kit

Chassis type “OEM kits” are also available to qualified integrators for use in customized enclosures and switchgear.

Content of the chassis kit:

Power Section consists of three identical SCR phase stacks, firing PC boards, power supplies to the firing PC boards, three CTs and the fiber optic harness that goes from the MV power assembly to the low voltage compartment. The Power Section is installed in the medium voltage compartment of the cabinet.

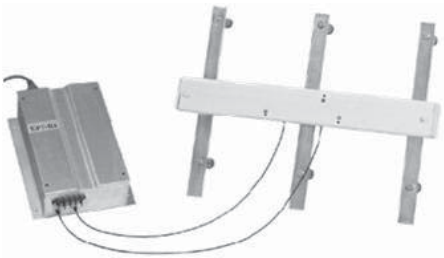
Power Section &
Connection Harness

Control Module is the “brain” of the soft starter. It consists of the main CPU PC board, firing PC board, power supply, option PC boards (when ordered) and input/output interface terminals. The Control Module is mounted in the LV compartment of the soft starter cabinet and completely isolated from the MV compartment. The Control Module is the same for all HRVS-DN ratings.

Control Module

Firing Transformer. This transformer is suitable for 115VAC or 230VAC control voltages. DC control voltage is available as an option (contact Solcon USA for details). The Firing Transformer is installed in the low voltage compartment and supplies control power to the firing PC boards located in the Power Section of the HRVS-DN soft starter.

EPT-Tx (transmitter) and EPT-Rx (receiver) are used to measure the input voltage. Solcon’s unique Electronic PT offers significant design advantages over ‘traditional’ voltage transformers. By using the EPT, each and every soft starter can be partial discharge tested to insure reliable, long term, ‘Corona Free’ operation.



Electronic P/T Receiver
(EPT-TX and EPT-RX)

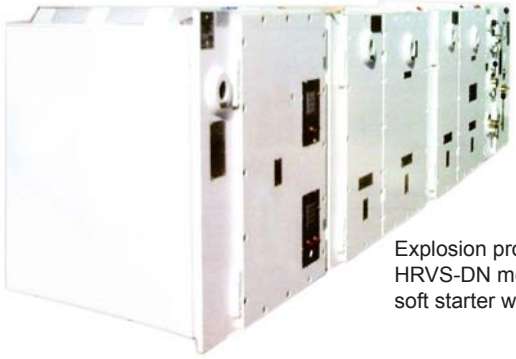
HRVS-DN “Custom Line Up” using OEM kit

Product Design

Custom Lineups and Special Designs

Solcon is well known for their ability to provide unique technical solutions to the most challenging application requirements. These include custom linueps, synchronous motor starters and multi-motor starting... just to name a few. And, Solcon is the only company in the world who can offer a medium voltage soft starter for use in explosive environments.

With ratings from 2.3 kV to 15kV and up to 2700A, Solcon can provide the medium voltage soft starter designed to meet your specific application needs.



Explosion proof
HRVS-DN medium voltage
soft starter with EEx-D[ia]I

Synchronous HRVS-DN medium voltage
soft starter with excitation controller

10 - 15kV HRVS-DN medium voltage soft starters
rated up to 2700A

Multi-start system HRVS-DN with built in PLC control for sequential soft
starting and stopping up to five MV motors

Metal-clad type construction

Specifications

General Specifications

Power components	Uniquely ordered and specially matched sets of thyristors (SCRs)
Converter circuit arrangement	Three-phase AC voltage controller
Controller	Fully digital with 32 Bit-Processor
System voltages	2.3 kV, 3.3 kV, 4.16 kV, 6.0 kV, 6.6 kV, 6.9kV, 7.2kV, 10kV, 11kV, and 13.8kV
Current ratings	40 - 2700A
System frequency	50 / 60 Hz, ± 3%
System voltage tolerance	+10 %, -15 %
Auxiliary power supply (control voltage)	1-ph. 110 - 230 V AC, 50/60 Hz (std) 1-ph. 220 - 240 V AC, 50/60 Hz 110 V DC 35 VA running, 350 VA starting
Electrical isolation between power section and control and feedback signals	Fiber optics
Degree of protection	IP00 (Chassis/OEM Kit) NEMA 12 (standard for 5kV, 200 - 600A models) NEMA 3R and other options available
Cooling method	Air Cooling / Forced Air Cooling
Complied standards	IEC, EN, NEMA, UL/CUL, CSA, IEEE
Paint finish	ANSI 61 and/or RAL 7032 standard, others upon request

Operation Conditions

Max. starting current		400 % of the starter's Full Load Current Rating (FLC)
Max. starting time		30 sec, at 400 % FLC
Max. number of starts		2 starts per hour at max. rated conditions (400 % I_R for 30 sec at 50 °C) (higher number of starts per hour based on the application)
Ambient temperature:	operating transportation storage	-10 to + 50 °C, max. 60 °C, de-rating by 10 % for each 5 °C above 50 °C -10 to + 50 °C -25 to + 70 °C
Installation altitude		Max. 1000m above sea level, for higher altitudes de-rating required (see instruction manual)
Maximum relative humidity		95 %, non-condensing

ANSI/IEEE System Protection Features

ANSI / IEEE Number	SYSTEM & PROTECTION FEATURES	STANDARD FEATURE
19	Reduced Voltage Soft Start	✓
27	Under Voltage or No Voltage	✓
37	Under Current	✓
46	Current Unbalance	✓
47	Phase Loss / Phase Sequence	✓
48	Locked Rotor / Incomplete Sequence / Max. Start Time	✓
49	I^2t Electronic Motor Overload	✓
50	Instantaneous Electronic Over Current Trip (Shear Pin)	✓
51L/R	TOC (Time Over Current) Phase	✓
55	Power Factor Trip	Optional
59	Over Voltage	✓
66	Too Many Starts (Starts Per Hour and Time Between Starts)	✓
81	Under / Over Frequency (<44Hz or >65Hz)	✓
86/94	Lockout / Start Inhibit	✓
51G & 51N	TOC (Time Over Current) Ground Fault Detection	✓
49R & 38	Stator and Bearing RTD Protection	Optional
87	Differential Protection	Optional

Specifications

Motor and Starter Protection

Name / Description	Adjustments	Active protection at:			
		Start	Run	Soft Stop	Stop
Too many starts and start inhibit time Prevents excessive starts during a set time period	- permitted number of starts: 1 - 4 - start period: 1 - 60 min - start inhibit time: 1 - 60 min (after too many starts)	+	-	-	-
Long start time Prevents stall condition, trips the starter if current does not drop to a fixed level within selected time.	- adjustable time: 1 - 30 sec	+	-	-	-
Over current shear-pin Trips the starter in less than 1 cycle when current exceeds 850 % I_{FLC}. Shear-pin ("immediate relay" set to "Shear-pin") - Stops (n/o trip) the motor when current exceeds the set level after preset time delay	- trip current: 200 - 850 % Motor FLC (during starting 850 %) - shear-pin delay: 0.5 - 5 sec (no delay at 850 %)	+	+	+	+
Motor overload/ Electronic overload Inverse time electronic overload becomes operational when RUN LED is lit. The O/L circuitry incorporates a thermal memory register calculating heating minus dissipation of the motor. The starter trips when the register fills up. The thermal register resets itself 15 minutes after the motor stops.	- selectable curves (NEMA & IEC) - motor FLA between: 75 - 150 % and factory set at 115 % - tripping time at 500 % FLA is adjustable between 1 - 10 seconds allowing trip curve selection.		+	-	-
Under current Trips the starter when current falls below the U/C Trip level after preset time delay. Under current auto reset allows for restarting after a predefined period of time to re-check the under current status.	- trip current: Off, 20 - 90 % I_{FLA} - trip delay: 2 - 40 sec	-	+	-	-
Under / no voltage Trips the starter when voltage drops below the U/V trip level after the preset selectable time delay. With programmable auto-reset.	- trip level: 60 - 90 % U_N - trip delay: 1 - 10 sec The starter will trip immediately, overriding the time delay if voltage drops to zero	+	+	+	-
Over voltage Trips the starter when voltage increases above the O/V trip level after the preset time delay.	- trip level: 110 - 125 % - trip delay: 1 - 10 sec	+	+	+	-
Phase loss Trips the starter when one or two phases are missing for over 1 sec. (programmable auto reset)		+	+	+	-
Phase sequence Trips the starter immediately when phase sequence is wrong.		+	+	+	-
Wrong connection / shorted SCR Trips the starter if: - motor is not properly connected to starters' load terminals - internal disconnect in the motor winding is detected - one or more SCRs are shorted - fiber optic lead insertion is incorrect		+	-	+	-
Starter (Heat sink) over temperature Thermal sensors are mounted on the heat sink and trip the starter when temperature rises above 85 °C		+	+	+	-
External fault 1 & 2 Inputs from two NO contacts. The starter trips 2 sec after either of the contactors close		+	+	+	+
Unbalance Current Operational after start signal, trips the starter when current unbalance exceeds the preset "UNBALANCE TRIP" setting for more than "UNBALANCE DLY" time setting Range: 10 - 100 %, delay: 1 - 60 sec.		+	+	+	-
Ground fault current Operational after start signal, trips the starter when ground current exceeds the preset "GND FAULT TRIP" for more than "GND FAULT DLY" time Range: 10 - 100 %, delay: 1 - 60 sec.		+	+	+	-
Power ON & No start signal Operational upon mains voltage connection. Trips the motor when mains is connected to the HRVS-DN for more than 30 sec without a start signal.		+	-	-	+
Bypass Open Operational when the bypass contactor does not close after "end of acceleration" contact signaled the interposing (pilot) relay to close.		-	+	-	-

"+" is active
"-" is not applicable or inactive

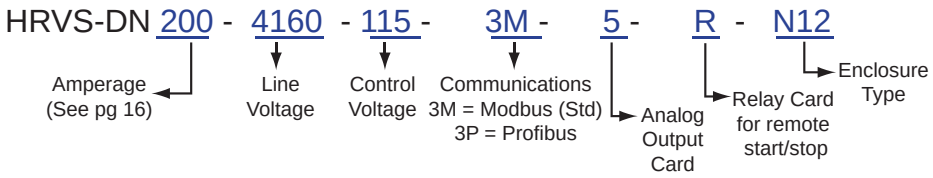
Product Selection

Standard Scope of Supply

Control input voltage	115VAC	Standard, 240VAC or 110-220VDC or 24VDC optional
Input / output cable entry	Top or bottom entry	Standard on all enclosed units
Main isolation switch	Class E2 starter version	Standard, option for VCB at higher ratings
Main fuses	Class E2 starter version	Standard
Line contactor	Fixed, vacuum	Standard, option for VCB at higher ratings
Bypass contactor	Fixed, vacuum	Standard, option for VCB at higher ratings
RTD Option	Optional	TPR 6-14 accepts up to 14 - PT100 RTD inputs
Motor protection relay	Optional	MPS3000 or other models available depending on application requirements
Digital panel meter	Optional	
Space heater	Optional	Standard in NEMA 3R outdoor design, thermostat controlled
Cooling fan	Optional	

How to Order

Example:



Available Options

Here are just a few of the many options and accessories available from Solcon. Contact us for your specific application requirements.

Code	Name / Description	Comment
Electrical options		
3P	RS-485 communication with PROFIBUS	No bridge required
Fan	Fan on top, air entry at bottom with filter and circuit breaker	For excessive starts per hour requirements
5	Analog output module	
MPS3000	Motor protection relay with 10 PT100 inputs	
400	400 V test voltage	for LV-motor test * (460V standard)
575	575 V test voltage	for LV-motor test *
690	690 V test voltage	for LV-motor test *

* Complete functional test of the soft starter can be carried out using a small LV motor (3 to 5HP).

Mechanical options		
Thick paint	Special painting, extra thick	Specify mil thickness and paint color
TIN	Tin-plated copper bus bars	
H1	Space heater with thermostat	
M	Suitable for marine applications	
Multi-start	For multi-motor applications	Contact factory for details

Spare part packages		
Spares 1 year	Spare parts package 1	Includes: 1 - Phase power section module 1 - Digital controller module 1 - Vacuum contactor 1 - Current transformer 1 - Electronic PT (Tx and Rx) 1 - Firing power supply board
Spares - 2 years	Spare part package 2	Includes: 2 - Phase power section modules 1 - Digital controller module 1 - Vacuum contactor 1 - Current transformer 2 - Electronic PT (Tx and Rx) 1 - Firing power supply board

Product Selection

Application Information

To select the right soft starter, generally only the motor nominal voltage and motor full load current (FLA) need to be known. However, when sizing HRVS-DN soft starters for special applications, environments or starting conditions, the following information should be provided before ordering:

1. General data required for standard soft starter applications:

1.1 Type of application (Pump, Compressor, Conveyor, etc.)
1.2 Motor Rated Power (KW or HP)
1.3 Motor Full Load Current (FLA)
1.4 Motor Nominal Voltage (V)
1.5 Motor Synchronous speed (RPM)
1.6 Motor current vs. speed curve or Ist/In (% or Per Unit)
1.7 Motor speed/torque curve
1.8 Tmax/Tn (% or Per Unit)
1.9 Rotor inertia J=GD2/4 (Kgm2)
1.10 Load speed/torque curve (% or per unit)
1.11 Load inertia J=GD2/4 (Kgm2) at motor speed
1.12 Number of starts per hour and time between starts
1.13 Cabinet degree of protection (1PXX or NEMA requirement)
1.14 Ambient temperature
1.15 Altitude (Meters or feet Above Sea Level)
1.16 Power cables entry (Top or Bottom)
1.17 Max. Shipping split dimensions (WXHXD)




2. Data to be requested for soft starters requiring synchronous motor exciters:

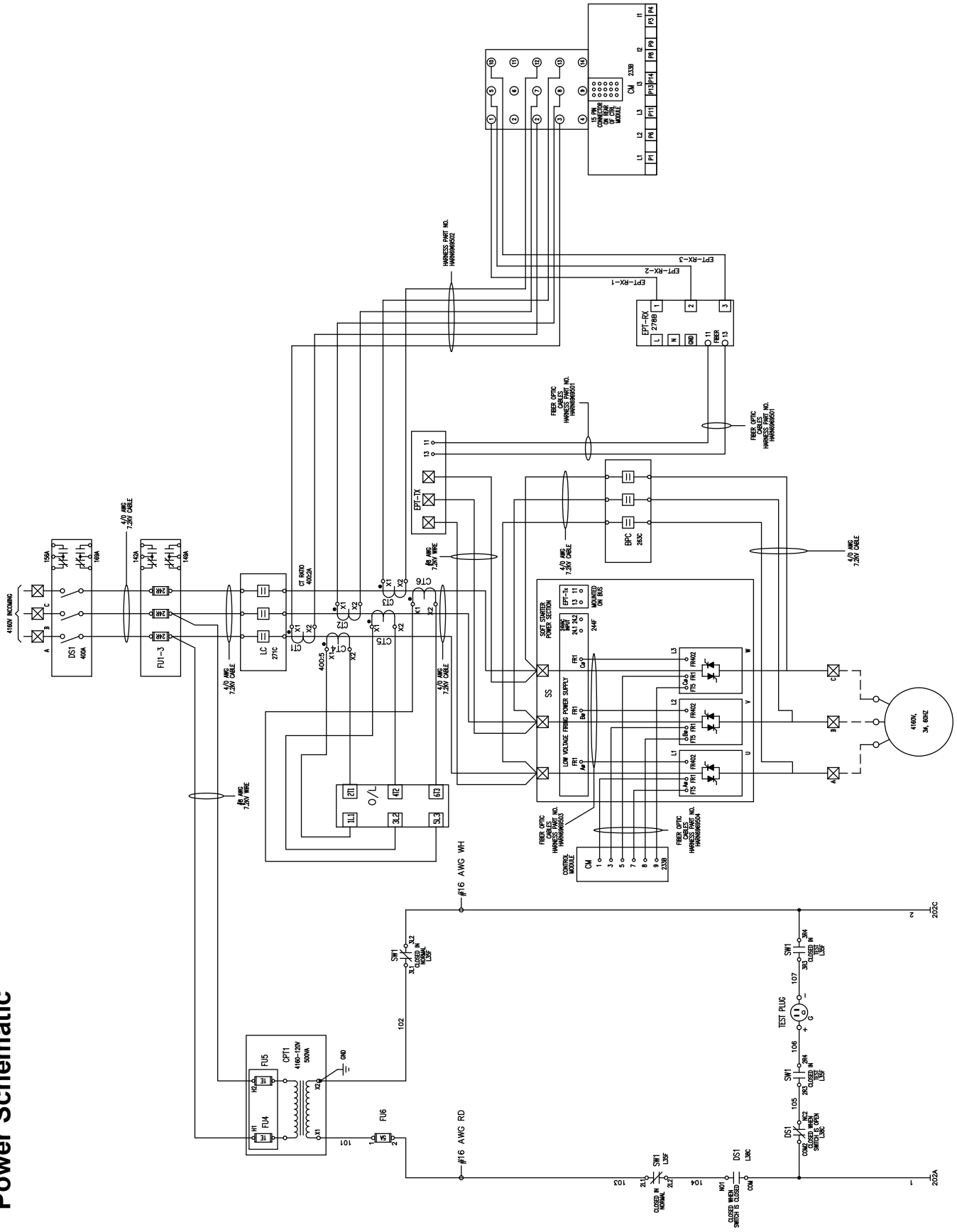
2.1 Type of exciter (Rotating or Static)
2.2 Full nameplate data of motor and exciter
2.3 Is it new or refurbished motor
2.4 Data for existing/old excitation system
2.5 For rotating exciter DC voltage, DC current of the exciter generator field
2.6 For static exciter DC voltage, DC current of motor field
2.7 For static exciter full data of field starting/discharge resistor
2.8 If retrofit application, will the existing static exciter field starting/discharge resistor be used? If not, will customer supply or is this in Solcon's scope of supply?
2.9 Availability of LV 3 phase supply KVA required: 250V X IDC X 3 phaseX 1.3. Advise voltage and frequency

Note:

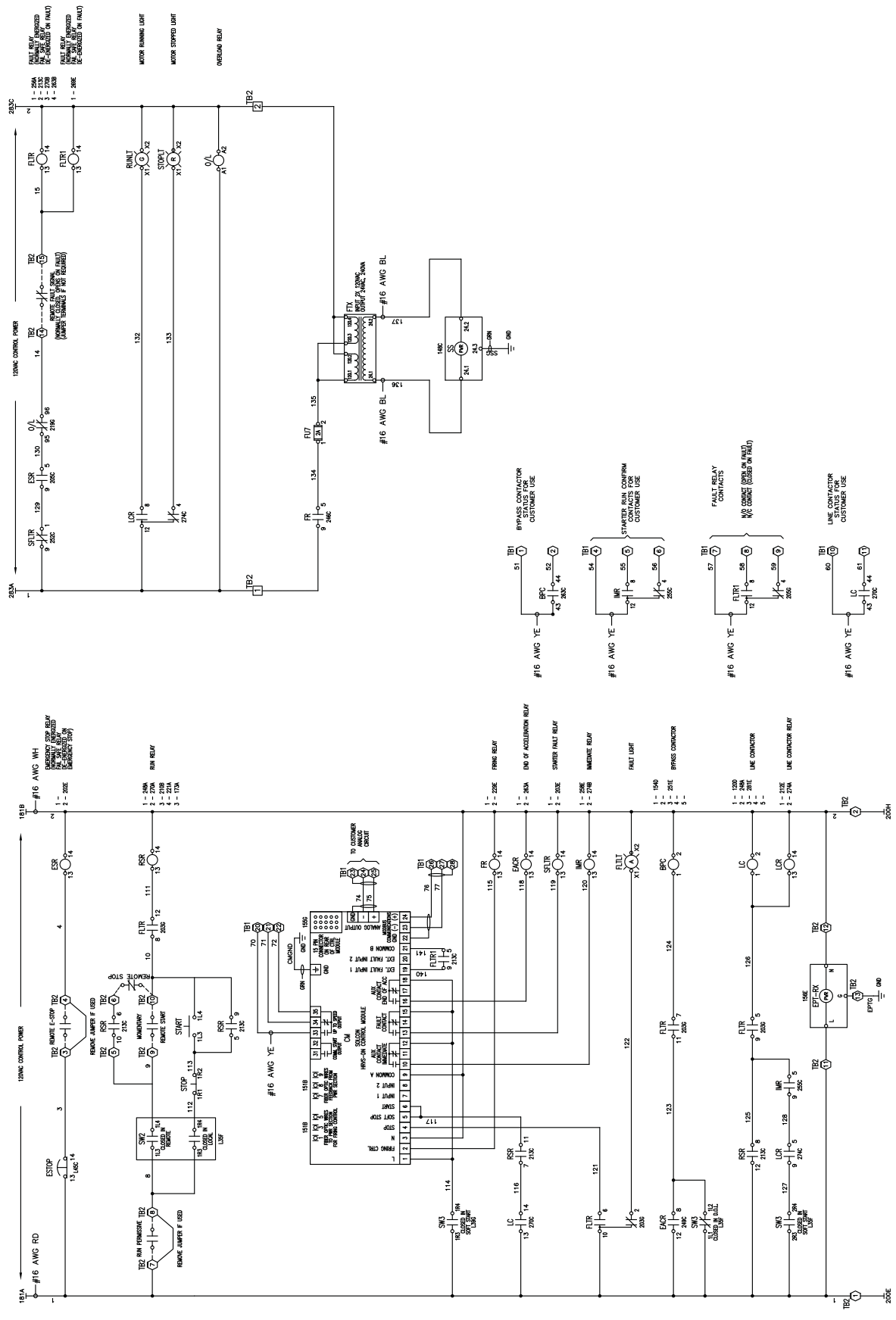
- A soft starter operated motor cannot deliver more torque than that of the motor started direct on line.

Wiring diagrams (Typical)

Power Schematic



Wiring diagrams (Typical)



Control Schematic

Ratings & Dimensions

Typical Ratings and Dimensions for Chassis and Enclosed Units

The starter must be selected based on the motor's Full Load Ampere (FLA) as indicated on its nameplate (even if the motor is not fully loaded). The kW and HP ratings given in the following selection table are related to standard motors and are for reference only.

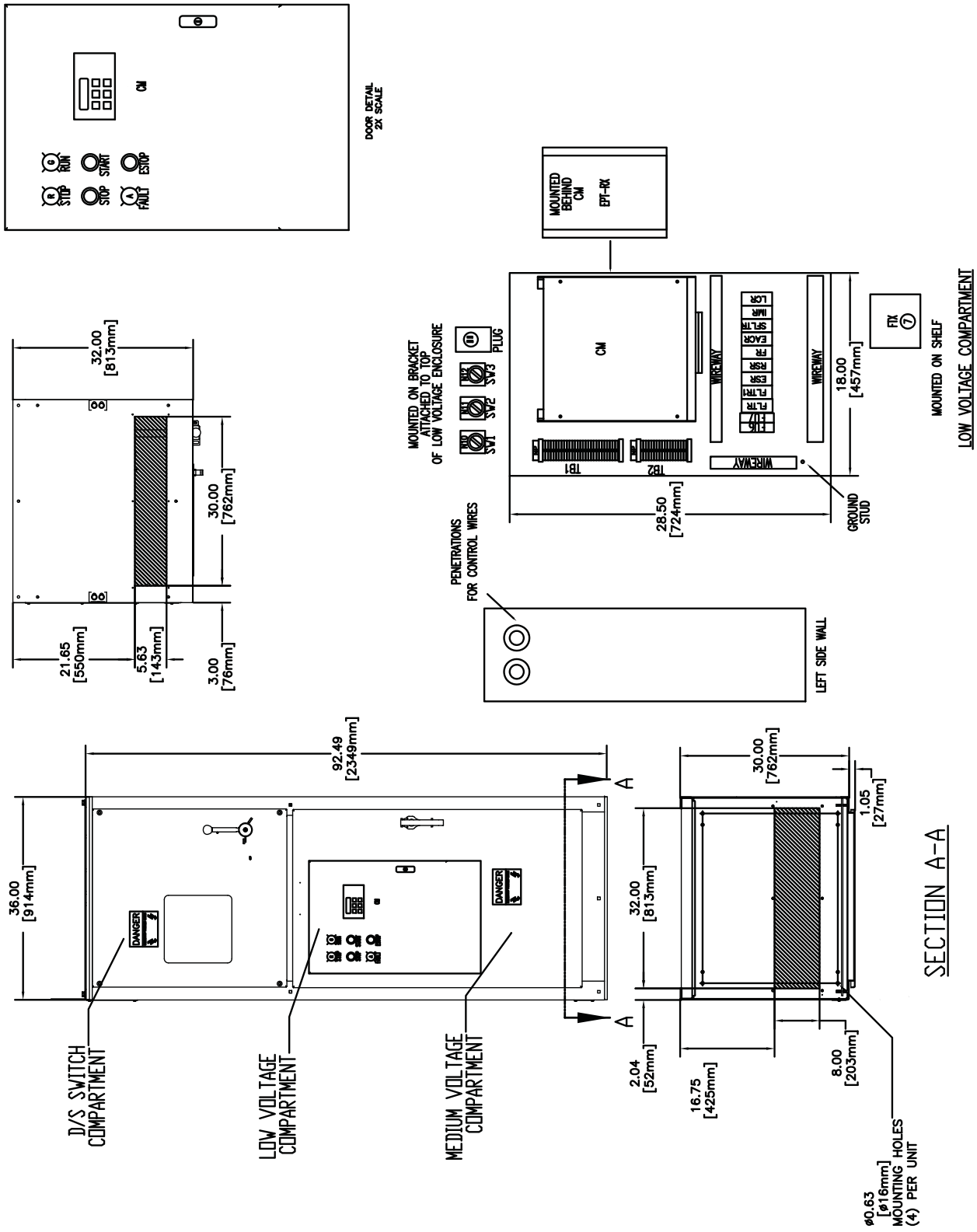
System Voltage	Starter Current	Motor HP	Motor KW	Starter Chassis (IP00)				Nema 1-3R,4,4X (IP31-67)			
				H	W	D	Lbs	H	W	D	Lbs
2300											
	110	500	360	23.0	30.0	18.5	284	92.0	36.0	30.0	1100
	200	900	660	23.0	30.0	18.5	290	92.0	36.0	30.0	1100
	400	1750	1330	23.0	30.0	17.0	356	92.0	36.0	30.0	1254
	600	2500	2000	31.5	26.0	19.3	440	92.0	72.0	30.0	2400
	800	3425	2660	44.1	35.4	24.4	770	92.0	96.0	36.0	3500
	1000	4275	3330	44.1	35.4	24.4	990	92.0	96.0	36.0	3500
3300											
	110	675	520	22.8	30.0	18.5	334	92.0	36.0	30.0	1210
	200	1225	950	22.8	30.0	18.5	336	92.0	36.0	30.0	1210
	400	2500	1910	22.8	30.0	19.8	449	92.0	36.0	30.0	1254
	500	3000	2340	22.8	30.0	21.3	550	92.0	72.0	30.0	2400
	600	3675	2850	33.1	31.4	23.6	770	92.0	72.0	30.0	2400
	800	4900	3820	44.1	35.4	24.4	880	92.0	78.0	36.0	2800
	1000	6125	4780	44.1	35.4	24.4	880	92.0	96.0	36.0	3500
4160											
	60	500	360	22.8	30.0	18.5	330	92.0	36.0	30.0	1210
	110	900	660	22.8	30.0	18.5	334	92.0	36.0	30.0	1210
	200	1500	1200	22.8	30.0	18.5	337	92.0	36.0	30.0	1210
	360	3000	2238	22.8	30.0	19.8	449	92.0	36.0	30.0	1300
	400	3250	2400	22.8	30.0	19.8	449	92.0	36.0	30.0	1300
	500	4000	3000	22.8	30.0	21.3	550	92.0	72.0	30.0	2400
	600	4500	3610	33.1	31.4	23.6	770	92.0	72.0	30.0	2400
	800	6175	4820	44.1	35.4	24.4	990	92.0	78.0	36.0	2800
	1000	7725	6030	44.1	35.4	24.4	1100	92.0	96.0	36.0	3500
6600											
	70	850	670	29.1	30.0	18.5	440	92.0	36.0	30.0	1300
	140	1725	1340	29.1	30.0	18.5	447	92.0	36.0	30.0	1300
	250	3000	2390	29.1	30.0	18.5	449	92.0	45.0	30.0	1700
	300	3500	2870	30.1	30.0	21.3	550	92.0	45.0	30.0	1700
	400	5000	3820	30.1	30.0	21.3	557	92.0	45.0	30.0	1700
	500	6000	4700	30.1	30.0	24.4	561	92.0	72.0	30.0	2600
	600	6750	5600	40.9	28.5	30.9	820	92.0	72.0	36.0	3100
	700	8575	6740	47.2	47.2	28.1	990	92.0	96.0	36.0	3500
	800	9800	7650	47.2	47.2	28.1	1210	92.0	96.0	36.0	3500
	1000	12250	9570	47.2	47.2	28.1	1430	92.0	96.0	36.0	3500
	1200	14700	11500	47.2	47.2	28.1	1430	92.0	96.0	44.0	4000
11,000											
	70	1500	1100	49.6	35.7	26.6	1100	92.0	126.0	44.0	4620
	140	3000	2200	49.6	35.7	26.6	1100	92.0	126.0	44.0	4620
	250	5100	4000	49.6	35.7	26.6	1100	92.0	126.0	44.0	4620
	300	6125	4800	49.6	35.7	26.6	1100	92.0	126.0	44.0	4620
	400	8175	6300	49.6	35.7	26.6	1100	92.0	126.0	44.0	4620
	700	14300	11200	67.0	59.1	29.5	1980	92.0	137.8	55.0	5940
	800	16350	12800	67.0	59.1	29.5	2090	92.0	137.8	55.0	5940
	1000	20425	16000	67.0	59.1	29.5	2200	92.0	137.8	55.0	6160
	1200	24525	19200	67.0	59.1	29.5	2200	92.0	137.8	55.0	6160
13,800											
	70	1800	1400	66.9	44.7	25.2	1980	92.0	126.0	44.0	6160
	140	3600	2800	66.9	44.7	25.2	1980	92.0	126.0	44.0	6160
	250	6400	5000	66.9	44.7	25.2	1980	92.0	126.0	44.0	6160
	300	8000	6000	66.9	44.7	25.2	2090	92.0	126.0	44.0	6160
	400	10000	8000	66.9	44.7	25.2	2200	92.0	126.0	44.0	6160
	700	18000	14000	55.1	118.1	29.5	2530	92.0	126.0	55.0	6380
	800	20000	16000	55.1	118.1	29.5	2530	92.0	165.4	55.0	6380
	1000	25000	20000	55.1	118.1	29.5	3080	92.0	165.4	55.0	6820
	1200	30000	24000	55.1	118.1	29.5	3300	92.0	165.4	55.0	6820

Note: Weights and dimensions are for reference only and are subject to change. Dimensions are in inches.
Contact Solcon USA for actual weight and dimensions.

Dimensional Drawings (Typical)

Dimensional drawings

Typical Enclosed unit NEMA 12
2.3 to 4.16 kV up to 400 A



Notes:

1. Dimensions are shown in mm and inches.
2. Dimensions are for reference only and are subject to change. Contact Solcon USA for exact dimensions.

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- Autotransformer Starters
- Wye Delta Starters
- DC Injection Brakes
- Motor Protection Relays
- RTD Relays
- SCR Power Controls
- Customized Drive & Starter Packages
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