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SIERS 2.0

Siemens integrated electrical racking system instruction manual
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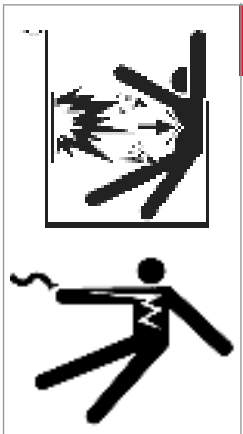
Table of Contents

Safety		3
Contact information		4
Receiving		5
Maintenance		5
Introduction		6
Setup Configurations		7
Section 1.0		8
1.0	Portable HMI Setup	8
1.1	Racking Mechanism	8
1.2	Control Power Requirements	8
1.3	Motor Characteristics and Data	8
1.4	Operational Interlocks	8
1.5	Position switches	9
1.6	Close and trip functions	10
1.7	HMI Interface and Controls	10
1.8	Portable Carrycase	11
1.9	Connecting the control cable	11
1.10	Operate from 120 Vac Power Outlet	12
1.11	Sequence of operation	12
1.12	Control Schematic	15
1.13	Operation Mode	15
Section 2.0		16
2.0	Local HMI Smart Setup	16
2.1	Racking Mechanism	16
2.2	Control Power Requirements	16
2.3	Motor Characteristics and Data	16
2.4	Operational Interlocks	16
2.5	Close and trip functions	17
2.6	Load HMI Cabinet	18
2.7	Operate from 120 Vac Power Outlet	19
2.8	Smart Stepper Motor	20
2.9	HMI Alarm Display	20
2.10	Connecting the portable HMI	20
2.11	Sequence of operation	21
2.12	Control schematic	24
2.13	Operation modes	24
Section 3.0		25
3.0	Alarms and troubleshooting	25
3.1	Alarms	26
3.2	Troubleshooting	26
3.3	Smart Motor Details	26
3.4	Spare parts	28
Section 4		29
4.0	Disposal	29

Note:
These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise that are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local sales office.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens Industry, Inc. The warranty contained in the contract between the parties is the sole warranty of Siemens Industry, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.

Safety



⚠ DANGER

Hazardous voltages and high-speed moving parts. Will cause death, serious injury, or property damage. Always de-energize and ground the equipment before maintenance. Read and understand this instruction manual before using equipment. Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions which will cause death, severe injury, or equipment damage. Follow all safety instructions contained herein.

Important

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligation. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material or both, the latter shall take precedence.

Qualified person

For the purpose of this instruction manual a qualified person is one who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received hazard safety training to identify the hazards and reduce the associated risk. In addition, this person has the following qualifications:

(a) Is trained and authorized to de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.

(b) Is trained in the proper care and use of protective equipment, such as: rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc. in accordance with established safety practices.

(c) is trained in rendering first aid.

(d) Is trained in the methods of safe release of victims from contact with energized electrical conductors or circuit parts.

Further, a qualified person shall also be familiar with the proper use of special precautionary techniques, personal protective equipment, insulation and shielding materials, and insulated tools and test equipment. Such persons are permitted to work within limited approach boundary, and shall, at a minimum, be additionally trained in all of the following:

- The skills and techniques necessary to distinguish exposed energized parts from other parts of electric equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed live parts.
- The approach distances specified in NFPA 70E® and the corresponding voltages to which the qualified person will be exposed.
- The decision-making process necessary to perform the job safety planning, identify the electrical hazards, assess the associated risks, and select the appropriate risk control methods including personal protective equipment.

Contact Information

Field service operation and warranty issues Siemens can provide competent, well-trained field service representatives to provide technical guidance and advisory assistance for the installation, overhaul, repair, and maintenance of Siemens equipment, processes, and systems.

Contact regional service centers, sales offices or the factory for details, or telephone Siemens field service at +1 (800) 333-7421 or +1 (423) 262-5700 outside the U.S.

For medium-voltage customer service issues, contact Siemens at +1 (800) 333-7421 or +1 (423) 262-5700 outside the U.S.

Signal words

The signal words “danger,” “warning,” and “caution” used in this instruction manual indicate the degree of hazard that may be encountered by the user.

These words are defined as:

Danger – Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

Warning – Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

Caution – Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.

Notice – Indicates a potentially hazardous situation that, if not avoided, may result in property damage.

Receiving and Inspection

When the equipment is received, follow the instructions for receiving, handling, inspection, and storage contained in the basic equipment instruction manuals. The racking system should be inspected for damage, including damage to the motor, racking screw, limit switches, control wiring, and control devices.

Maintenance

The SIERS 2.0 electrical racking system should be maintained in the same manner as the standard racking system as outlined in maintenance section of the basic equipment manuals.

Maintenance and lubrication are recommended at five-year intervals when the equipment is operated under ANSI/IEEE “usual service conditions,” as discussed in ANSI/IEEE C37.20.2, clauses 4 and 8.1.

During maintenance, old grease should be cleaned off, and the racking screw lubricated with Siemens lubricant 15-172-879-201.

Introduction

Siemens Integrated-Electric Racking System (SIERS 2.0) is available for 5, 15, and 27 kV GM-SG non-arcresistant and GM-SG-AR non-arc-resistant switchgear. SIERS 2.0 is available in two control setup configurations:

- Portable HMI Setup
- Local HMI Smart Setup

This instruction manual is divided into two sections. Refer to the appropriate section in the instruction manual for the SIERS control setup installed and implemented in the switchgear equipment. Refer to the following sections below for instructions on the setup configuration installed in GM-SG switchgear of concern.

- Section 1: Portable HMI Setup
- Section 2: Local HMI Smart Setup

This instruction manual supplements the instruction manual for the GM-SG and GM-SG-AR switchgear families and describes the supplemental features of the Siemens integrated electrical racking system (SIERS 2.0).

Refer to these instruction manuals for specific switchgear:

- GM-SG non-arc-resistant switchgear (E50001-F710-A230-XX-XXXX)
- GM-SG-AR arc-resistant switchgear (E50001-F710-A254-XX-XXXX)
- GM-SG-EO ground and test device (SIEA-T40021-00-4AUS)

Read, understand, and follow all the safety advisories, instructions, and procedures contained in the reference manuals. For convenience, these instruction manuals will hereafter be referred to as the basic equipment manuals.

Setup Configurations

Portable HMI Setup

SIERS 2.0 Portable HMI setup is supplied with a motor fixed-mounted on the racking mechanism for each circuit breaker compartment, and optionally available for voltage transformer, control power transformer, and fuse auxiliary truck compartment. It consists of the following key components:

- One light-weight portable carrycase will be equipped with HMI, logic controller, components, and a 30-ft cord to connect to the associated removable element to be racked. One carrycase will be shipped with the order (see Figure 1).
- Each removable element compartment is equipped with a motor and limit switches integrated into racking mechanism assembly (see Figure 5).

First, the motor is operated, controlled, and protected by the HMI, logic controller and the other control devices in the portable carrycase simply by plugging the 30-foot cable into a connector of the removable element located on of the low voltage compartment door. Then the operator plugs the other end of the 30-foot cable into receptacle on the side of the carry case, locates the case outside of the arcflash boundary, and performs open or close function and/or the racking process.

Local HMI Setup

This more advanced set up of SIERS 2.0 includes a stepper motor fixed-mounted on the racking mechanism for each circuit breaker compartment, and optionally available for voltage transformer, control power transformer auxiliary truck compartment. This step consists of the following key components:

- CPU controller along with portable HMI installed in low voltage compartment or control cabinet mounted on side of switchgear for indoor enclosure (see Figure 2).
- Stepper motor integrated into racking mechanism assembly located inside the circuit breaker and optionally in the auxiliary truck compartments (see Figure 15).

The stepper motors are daisy-chain connected via communication cable to a single CPU along with control devices located either in an empty compartment in the GM-SG lineup, or in a separate cabinet located the sidewall of GM-SG or GM-SG-AR lineup. One handheld HMI is also provided and located where the CPU is.

Figure 1: Portable HMI Setup Configuration

Figure 2: Local HMI Setup Configuration

SECTION 1.0

1.0 Portable HMI Setup

1.1 Racking Mechanism

The SIERS 2.0 Portable HMI Setup is arranged with the motor integrated fixed-mounted racking mechanism inside each removable element located in the upper and lower compartments in the switchgear lineup (see Figure 3). Limit switches, LS1, LS2, LS3, and LS4, are also integrated into the racking. The limit switches are used to provide input to the logic controller. SIERS enables racking the circuit breaker to the DISCONNECT, TEST, and CONNECT positions, and auxiliary trays to the DISCONNECT and CONNECT positions. The LS1, LS2, and LS3 switches provide inputs to the logic controller located in the portable case to track the CONNECT, TEST, and DISCONNECT positions, respectively.

1.2 Control Power Requirements

SIERS 2.0 Portable HMI with carrycase controls will operate on either 120 VAC or 125 VDC control power. Whichever is available in your switchgear, SIERS 2.0 will perform the racking process. If power source is not available in the switchgear, SIERS can be plugged into 120 VAC power outlet. See Figure 8 for where to plug 120 VAC power outlet.

1.3 Motor Characteristics and Data

The 125 VDC motor is integrated in the racking mechanism assembly. The following table describes the motor characteristics.

Table 1: Motor Characteristics

Voltage (V)	I nominal (A)	I max (A)	Racking time (s)
125	0.9	2.3	25

1.4 Operational Interlocks

Operational interlocks are programmed in the logic controller and displayed on the HMI screen in the portable control carry case.

Interlock and operation for removable elements
There are three interlock permissive circuits wired for every circuit breaker cell that is equipped with SIERS 2.0 integrated electrical racking.

1. Mechanism operated contact (MOC) switch is wired into the SIERS control circuit to only allow remote racking of the circuit breaker when the circuit breaker is open. If the circuit breaker is closed (this can occur only in the TEST or CONNECT position), the MOC switch will close, and the SIERS motor will not receive power to operate. This interface with the MOC switch inside the compartment is not applicable for Electrically Operated Ground and Test Devices (EO G&TD) and auxiliary trucks for control power transformers, voltage transformers, and fuses

   Note: The EO G&TD must always be opened before using SIERS to rack to avoid damaging the racking mechanism.

2. The manual racking permissive switch (LS4 limit switch) is actuated when the manual racking crank is inserted. When the LS4 switch is actuated, electric racking is disabled.

3. The door permissive switch (LS5 limit switch) normally open contact is installed on the compartment door frame for GM-SG-NonAR and inside the compartment on the racking mechanism for GM-SG-AR. The circuit breaker compartment door must be closed and latched to allow electrical racking (see Figures 4 and 5).

Figure 3: Racking mechanism with LS4 position switch shown

Figure 4: LS5 switch for GM-SG NonAR compartment door shown

Figure 5: LS5 switch for GM-SG-AR compartment door shown

Interlock and operation of auxiliary truck

To rack a CPT rollout truck or a CPT fuse rollout truck, it is necessary to open the secondary molded case circuit breaker and block its closure using the kirk key interlock. Refer to the applicable GM-SG or GM-SG-AR switchgear instruction manual for detailed instructions.

1.5 Position switches

LS1, LS2, and LS3 position switches

Each circuit breaker racking mechanism equipped with 3 fixed-mounted plunger type limit switches (LS1, LS2, and LS3), used for inputs to the logic controller located in the portable carry case.
The LS2 limit switch is not provided in auxiliary compartments. Each position switch is affixed onto the racking mechanism to provide input on the current position of the removable element.

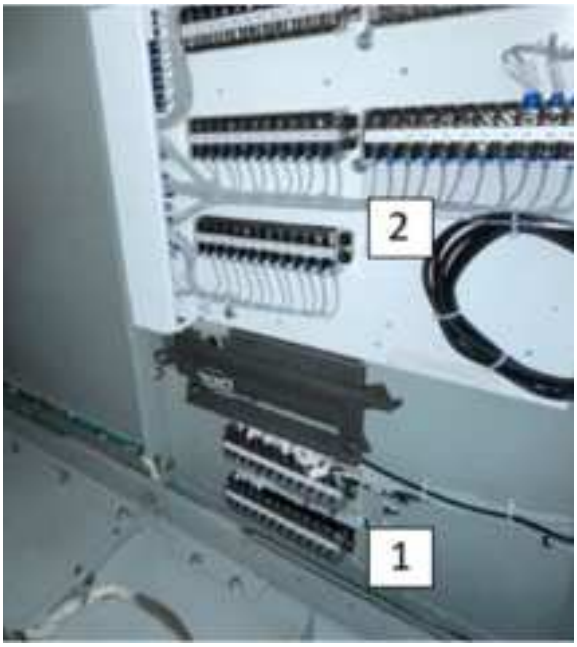


Figure 6: Interface terminal block assembly below MOC and TOC assembly for GMS-SG and GM-SG-AR up to 50 kA

1.6 Close and trip functions

Circuit breaker remote control functions

The close and trip commands are from the HMI and logic controller located in the carry case through hardwires on the Interface Terminal Block to the close and trip circuits. See Figure 6 and table 2 for details Interface Terminal Block.

Table 2: Interface Terminal Block

Item	Description	Designation
1	SIERS terminal block	ITB
2	MOC & TOC Assembly	MOC/TOC

1.7 HMI Interface and Controls

Fixed HMI and Controls in Portable Carry Case

HMI and controls components are fixed-mounted and integrated inside the portable control carry case (see Table 3, Figure 7 and Figure 8). The HMI displays the racking device commands, red (CONNECT), amber (TEST) and green (DISCONNECT), plus the Close and Trip commands for circuit breaker operation.

The portable carrycase includes a PWR/control cable of 30 ft (9.1 m) length that is connected to the plug in the low voltage section for the removable element compartment.

The control components are assembled in the carry case are described in table 3 and shown in Figure 8.

Table 3: Components in portable control carry case

Item	Description	Designation
1	Siemens Logo8! Logic Module	LM
2	Power Supply 24 Vdc	PS
3	Motor Relays	M1 - M4
3.1	Motor Aux. Relays	M1 - M2
3.2	Close/Trip Aux Relays	M3 - M4
4	Voltage Relay	VR
5	Current Sensor	CS
6	Rectifier	REC
7	HMI Display	HMI
8	Miniature Circuit Breaker	CBM1 - CMN2
9	External 120 Vac Flange Inlet Type 5-15P for 5-15R Receptacle	EXT

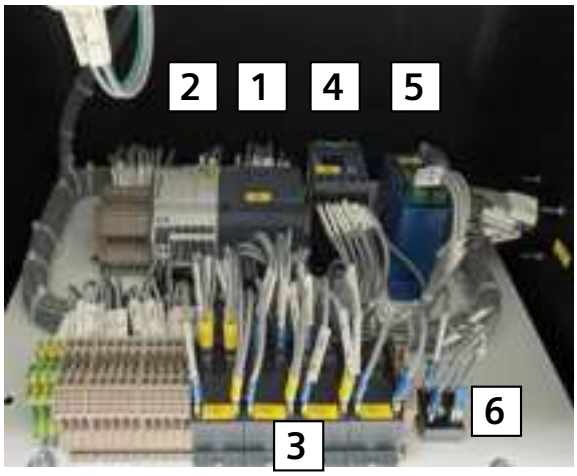


Figure 7: Layout of controller and devices in portable control carry case

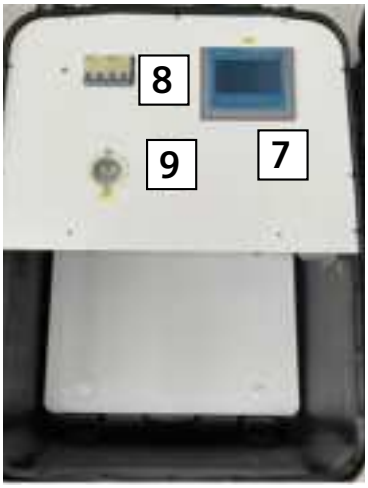


Figure 8: Layout of user interface for control carry case

1.8 Portable control carry case

Carry case information

The control carry case is light-weight incorporating the components described in Table 3 along the with a PWR/control cable that extends up to 30 ft length from the removable element selected to operated (see Figure 9 below).

Figure 9: Portable control carry case

1.9 Connecting the control cable

PWR/Control cable

The 30-foot long PWR/Control Cable is stored portable control carry case. Each end of the cable is suited to connect to a 16-pin receptacle is located on the side of the portable control carry case and another 16-pin receptacle is located on the front of the low voltage compartment of each removable element in the lineup for individual racking or close/trip a removable element.

1.10 Operate from 120 Vac Power Outlet

Operating with external power

In the event control power is not available from the switchgear lineup, external 120 Vac power from receptacle in the electrical room or building can be used to power SIERS to perform the racking operation. The portable control carry case is provided with a 120 VAC flanged inlet type 5-15P to accept an extension cord fitted with a 5-15R receptacle. See item 9 in Table 3 and Figure 8. Insert the receptacle end of the extension cord into the auxiliary power plug in the portable case, then plug in the extension cord in the nearby 120 Vac power outlet in area, switch in the miniature circuit breaker.

1.11 Sequence of operation

Circuit breaker racking operation

The following describes the sequence of operation for racking the draw out circuit breaker. Follow the safety guidelines and recommendations outlined in the safety section of this manual. Also, refer to the instruction manuals for specific switchgear: GM-SG non-arc-resistant switchgear (E50001-F710-A230-XX-XXXX) and GMSG-AR arc-resistant switchgear (E50001-F710-A254-XX-XXXX) for additional information.

The following steps describe the operation sequence using the Portable HMI to rack a circuit breaker.

1. Place the portable control carry case to the appropriate location outside of the arc-flash boundary of energized switchgear or up to 30 feet from the switchgear.
2. Plug in the PWR/control cable from the portable control carry case into the 16-pin receptacle on the side of portable carrycase and the other end of cable to the receptacle located on the low voltage compartment for the corresponding circuit breaker compartment.

IMPORTANT: *When first time operating SIERS, start with removable element in the DISCONNECT position. On a de-energized lineup use the manual racking crank provided with the accessories to rack the removable element to the DISCONNECT position in the compartment.*

3. Starting with the circuit breaker in DISCONNECT position.
4. Follow the instructions in the relevant GM-SG, GM-SG-AR switchgear instruction manual.
   a. The circuit breaker is now in the DISCONNECT position.
   b. The solid green indication (for DISCONNECT) on the HMI display will illuminate.
5. Ensure the main compartment door is closed and latched. If the door is not closed, SIERS will be disabled; an alarm will indicate on the HMI screen.
6. Ensure the CBM 1 and CMB 2 miniature circuit breakers in the portable control case are switched ON to turn on HMI touchscreen interface.
7. Touch TEST on the HMI touchscreen to initiate command to rack the circuit breaker to the TEST position. Note: It is not necessary to keep touching the screen. The circuit breaker will move to the TEST position.
8. When the circuit breaker begins to move, the green indication (for DISCONNECT) will turn off.
9. When the circuit breaker reaches the TEST position, the amber indication (for TEST) will turn on.
   a. In the TEST position, the secondary disconnects will mate, and the removable element will now have control power.
   b. In the TEST position, the OPEN and CLOSE commands can be performed on the removable element from the HMI touchscreen.

10. To proceed to the CONNECT position, the circuit breaker must indicate OPEN on the HMI touchscreen. If the circuit breaker is not in OPEN status, SIERS will not allow racking to the circuit breaker to CONNECT position.

11. Touch CONNECT on the HMI display to rack the circuit breaker to the CONNECT position.

    Note: *It is not necessary to maintain constant pressure on the touchscreen. Upon initiating this command, the amber indication (for TEST) will turn off. When the* circuit breaker *reaches the CONNECT position, the red indication (for CONNECT) will turn on.*

12. When the circuit breaker is in the CONNECT position, it can be operated to CLOSE or OPEN from the HMI display in the portable carrycase.

13. To rack the circuit breaker from CONNECT to TEST or DISCONNECT, the circuit breaker must be tripped OPEN. The OPEN command can be initiated from the HMI touchscreen If the circuit breaker is not in OPEN status, SIERS will not allow racking to the circuit breaker from CONNECT to the TEST or DISCONNECT position.

Auxiliary truck racking operation

The following describes the sequence of operation for racking voltage transformer, control power transformer, or fuse truck. Always refer the safety guidelines and recommendations outlined the safety section of this manual. Also, refer to the instruction manuals for specific switchgear: GM-SG non-arcresistant switchgear (E50001-F710-A230-XX-XXXX) and GM-SG-AR arc-resistant switchgear (E50001-F710-A254-XX-XXXX) for additional information.

Tip(s): *When control power is not available in the switchgear, then use 120 VAC power via external power outlet in the electrical room or area to operate SIERS 2.0 to remotely rack the auxiliary truck.*

Figure 12: HMI Displays Device in DISCONNECT (green indication) position

Figure 13: HMI Displays Device in CONNECT (red indication) position

Figure 14: Displays Device in TEST (amber indication) position

The following steps describe the operation sequence using the Portable HMI to rack an auxiliary truck.

1. Place the portable carrycase to the appropriate location outside of the arc-flash boundary for energized switchgear or up to 30 feet from the switchgear.

2. Plug in the PWR/control cable from the portable case into the 16-pin receptacle on the side of portable carrycase and the other end of cable to the receptacle located on the low voltage compartment for the corresponding circuit breaker compartment.

   IMPORTANT: *When first time operating SIERS, start with auxiliary truck in the DISCONNECT position. On a de-energized lineup use the manual racking crank provided with the accessories to rack the auxiliary truck to the DISCONNECT.*

3. Starting with the auxiliary truck in the DISCONNECT position in the auxiliary compartment.

4. Follow the relevant instruction manual for GM-SG, or GM-SG-AR switchgear.

   a. The auxiliary truck is now in the DISCONNECT position.

   b. The solid green indication (for DISCONNECT) on the HMI display will illuminate.

5. Ensure the auxiliary compartment door is closed and latched. If the door is not closed, SIERS will be disabled; and alarm will indicate on the HMI screen.

6. Ensure the CBM 1 and CMB 2 miniature circuit breakers in the portable carrycase are switched ON to turn on HMI touchscreen interface.

   IMPORTANT: *Before racking the CPT truck in the CONNECT or DISCONNECT position, the secondary moldcase circuit breaker must be OPEN, disconnected to flow of secondary current from the CPT.*

7. Before racking an auxiliary truck with Control Power Transformer (CPT) or fuse roll-out truck for a CPT, the secondary molded case circuit breaker (MCCB) must be opened, and the key interlocked.

   Note: *This step is not required for voltage transformer (VT) truck.*

8. After step 7 above is performed, SIERS will allow the auxiliary truck to be racked.

9. When the auxiliary truck begins to move, the green indication (for DISCONNECT) will turn off.

10. When the auxiliary truck reaches the CONNECT position, the red indication (for CONNECT) will turn on.

    a. The auxiliary truck is now in the CONNECT position; for CPT or fuse truck, the secondary molded-case circuit can be turned on. Follow the instructions in the relevant GM-SG or GM-SG-AR instruction manual.

11. To rack a CPT or fuse truck from CONNECT to DISCONNECT, the molded-case secondary circuit breaker must be opened and interlocked with the kirk key features.

12. For CPT or fuse truck, once the molded-case secondary molded-case circuit breaker is opened (turned off) and interlocked, SIERS can be used to rack the CPT or fuse truck to the DISCONNECT position.

13. Touch DISCONNECT on the HMI display. The auxiliary truck will move towards the DISCONNECT position.

14. The red indication (for CONNECT) will turn off.

15. Once the auxiliary truck reaches the DISCONNECT position, the green indication (for DISCONNECT) will turn on.

1.12 Control Schematic

The schematic diagram below, figure 11, provides information on how the components and devices are connected to rack the removable element and perform the close and trip operations for SIERS Portable HMI with control carry case setup.

1.13 Operation Mode

During manual racking mode, SIERS is disabled when the manual racking crank is fully inserted onto the racking mechanism shaft activating the LS4 permissive switch. In electric racking mode, the manual racking crank should not be inserted. In electric racking mode, SIERS will perform the racking process.

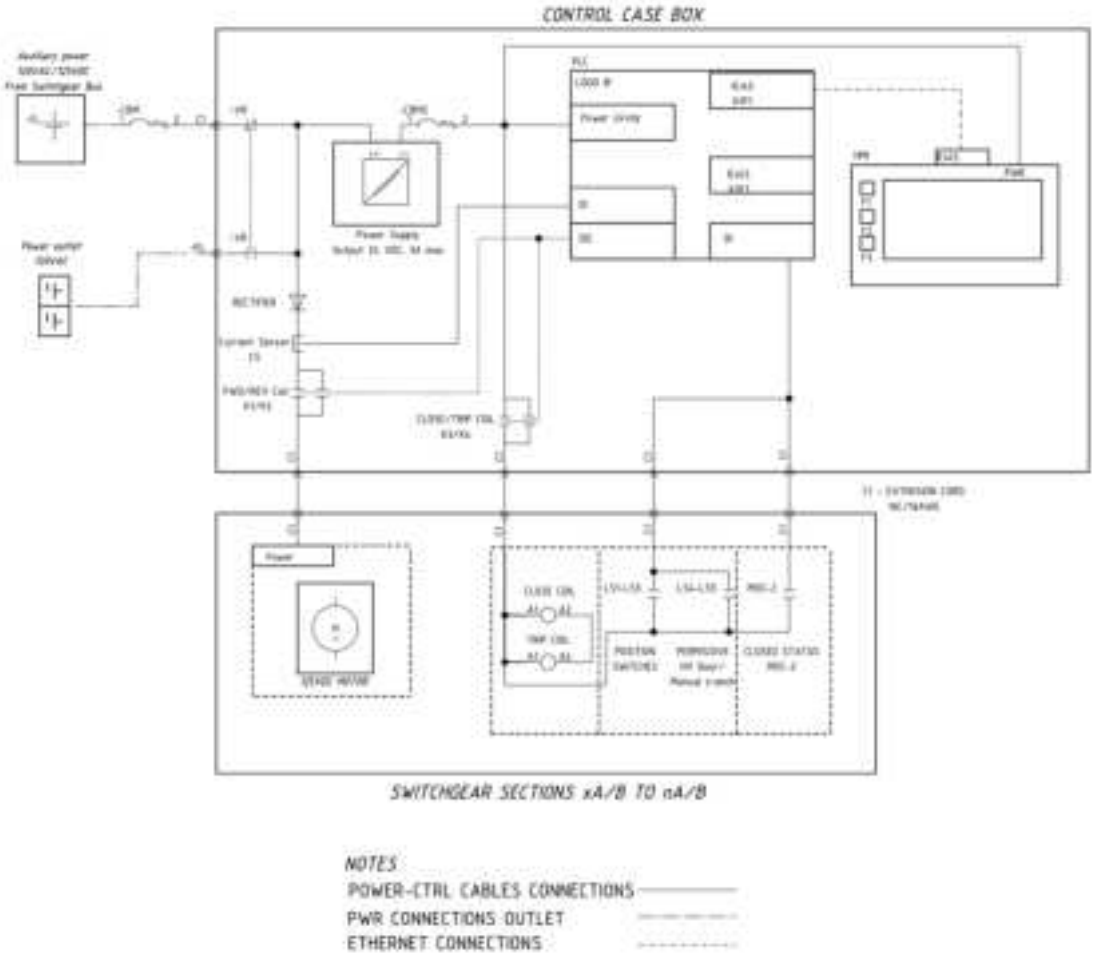


Figure 11: Schematic diagram for Portable HMI with Carry Case setup

SECTION 2.0

2.0 Local HMI Setup

2.1 Racking Mechanism

The SIERS 2.0 Local HMI Smart Setup is arranged with the stepper motor integrated fixed mounted in the racking mechanism inside each circuit breaker or auxiliary truck (i.e., removable elements) located in the upper or lower compartment in the switchgear lineup (see Figure 2). SIERS enables racking the circuit breaker to the DISCONNECT, TEST, and CONNECT positions, and auxiliary truck to the DISCONNECT and CONNECT positions.

2.2 Control Power Requirements

SIERS 2.0 controls will operate on either or 125 - 250 Vdc control power, whichever is available in your switchgear. If power source is not available in the switchgear, SIERS can be plugged into 120 VAC power outlet. See Figure 20 for where to plug 120 VAC power outlet.

2.3 Motor Characteristics and Data

The 60 VDC stepper motor is integrated in the racking mechanism assembly with the following characteristics.

Table 4: Motor Characteristics

Voltage (V)	I nominal (A)	I max (A)	Racking time (s)
60	3.0	6.0	40

60 sec for 27kV

2.4 Operational Interlocks

Operational interlocks are programmed in the logic CPU and displayed on the HMI touchscreen interface.

Interlock and operation of removable elements
There are only 3 interlock permissive circuits wired for every circuit breaker compartment, and 2 interlock permissive circuits for each auxiliary truck compartment.

1. A mechanism operated contact (MOC) switch contacts are wired into the control circuit to only allow remote racking of the circuit breaker when the circuit breaker is open. If the circuit breaker is closed (this can occur only in the TEST or CONNECT position), the MOC switch will close, and the SIERS motor will not receive power to operate. This interface with the MOC switch inside the compartment is not applicable for Electrically Operated Ground and Test Devices (EO G&TD) and auxiliary trucks for control power transformers, voltage transformers, and fuses

   Note: The EO G&TD must always be opened before using SIERS to rack to avoid damaging the racking mechanism.

2. The manual racking permissive switch (LS4 limit switch) is actuated when the manual racking crank is inserted. When the LS4 switch is actuated, electric racking is disabled (see Figure 15).

3. Normally open contact installed on the compartment to sense door position. If the circuit breaker compartment door is open, the LM blocks power through the permissive switch (LS5) to the racking motor. The compartment door must be closed to enable integrated electrical racking (see Figures 16 and 17).

Figure 15: Racking Mechanism for HMI Setup

Figure 16 : LS5 Switch for GM-SG NonAR Compartment Door Shown

Figure 17: LS5 door Switch for GM-SG-AR Compartment

Interlock and operation of auxiliary truck

In order to rack a CPT rollout truck or a CPT fuse rollout truck, it is necessary to open the secondary molded case circuit breaker and block its closure using the kirk key interlock. Refer to the applicable GM-SG or GM-SG-AR switchgear instruction manual for detailed instructions.

2.5 Close and Trip Functions

Circuit breaker remote control functions

Each circuit breaker compartment is equipped with a close and a trip auxiliary relay. These relays are wired into the circuit breaker close and trip control circuits. The physical location of these auxiliary relays is in the racking device, behind the stepper motor. These relays provide inputs to the logic CPU and the HMI on the status (open/close) of the circuit breaker, as well as receives commands form HMI and the CPU to close or trip through contacts wired in the close and trip control circuit. See Figure 18 for the locating of the close and trip auxiliary relays.

Table 5: Components in SIERS 2.0

Item	Description	Designation
1	SIERS Interface Terminal Block	ITC
2	MOC & TOC Assembler	MOC/TOC
3	Racking Mechanism	RM
4	Auxiliary Relays	AUX
5	Stepper Motor	MOTOR

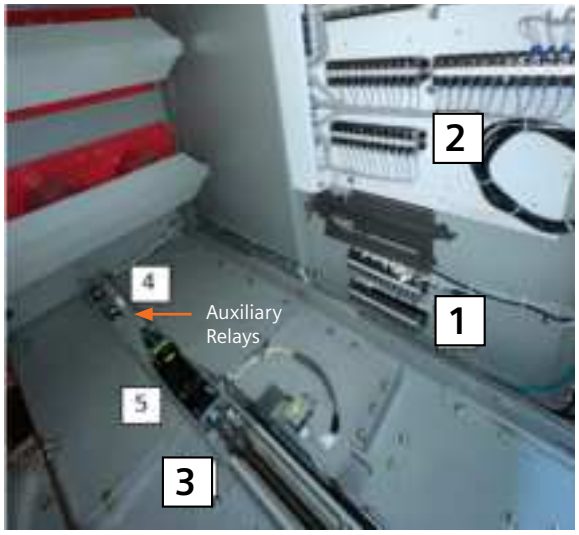


Figure 18: Auxiliary Relays

2.6 Load HMI Control Cabinet

Local HMI and Control Devices in Low Voltage Compartment or Control Cabinet

SIERS 2.0 Local HMI Smart includes a Siemens S7- PLC CPU or Central Processing and control devices all centrally installed and fixed mounted in an available low voltage compartment within the switchgear lineup and if compartment space is not available in the switchgear the CPU and controls will be installed inside a control cabinet mounted to end of the switchgear lineup.

Also, portable HMI touchscreen should be always stored in the same location as the CPU and control devices. The HMI displays the racking device commands, red (CONNECT), amber (TEST) and green (DISCONNECT), plus the Close and Trip commands for the circuit breaker operation.

Stored along with portable HMI is a cable cord with an extension of 30 ft (9.1 m) long that connects to a receptacle in the control cabinet or in the low-voltage compartment of the switchgear.

Figure 19: Local HMI Smart Setup with Control Cabinet Installed on the Side of Lineup

Table 6: Components in SIERS 2.0

Item	Description	Designation
1	Siemens S7 CPU	LM
2	Power Supply for Motor	PSM
3	Power Supply for Controls	PSC
4	Communications Switch Module	CSM
5	HMI Display	HMI
6	Voltage Relay	VR
7	Miniature Circuit Breaker	CBM1 - CBM3
8	External 120 VAC flange inlet type 5-15P for 5-15R receptacle	EXT
9	PROFINET Connector	CON

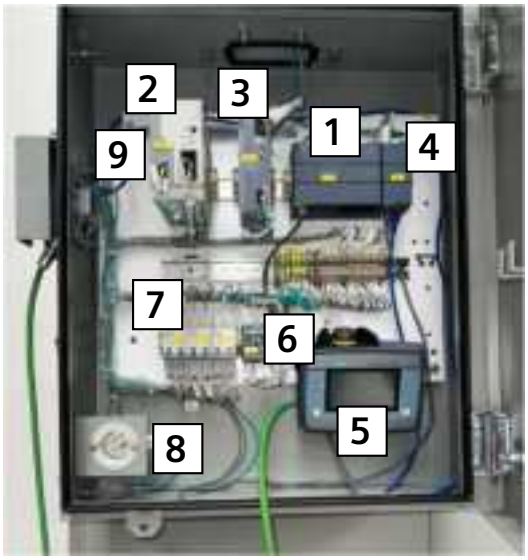


Figure 20: Local HMI Smart CPU and Control Cabinet Installed on the Side of Lineup

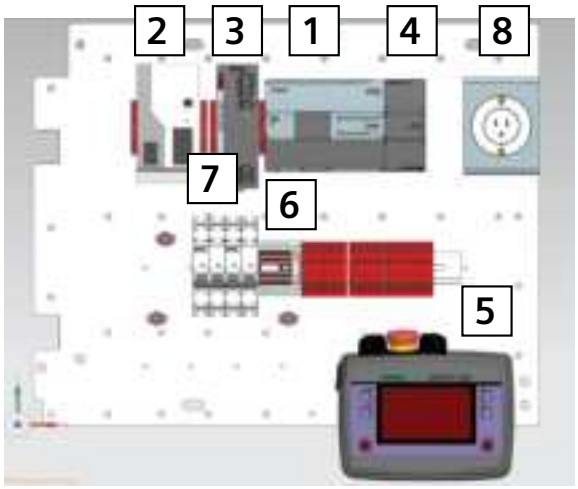


Figure 21: CPU and Control Cabinet Installed Inside Available Low Voltage Compartment

Figure 22: Portable HMI stored and mounted bracket inside low voltage compartment

2.7 Operate from 120 Vac Power Outlet

Operating with external power

In the event control power is not available from the switchgear lineup, external 120 Vac power from receptacle in the electrical room or building can be used to perform the racking operation. The portable carrycase is provided with a 120 VAC flanged inlet type 5-15P to accept an extension cord fitted with a 5-15R receptacle. See Table 3 item 8, Figure 20, and Figure 21.

Insert the receptacle end of the extension cord into the auxiliary power plug in the control cabinet or low voltage compartment, then plug in the extension cord in the nearby 120 Vac power outlet in area and perform the required racking per the instruction outlined in this instruction manual.

2.8 Stepper Motor

Advanced stepper motor technology
The stepper motor has a built-in torque measurement to detect and indicate excessive torque and overload due to jam, interference, or otherwise. When the percent torque is exceeded, the motor sends the alarm signal to the CPU and an alarm will be displayed. The motors are connected to the CPU via PROFINET connections and can be daisy chain to subsequent motors.

Position sensing for removable elements
Position switches are not used for the Load HMI Smart setup. The position sensing for the removable elements are tracked by the stepper motor. Position sensing is performed via the motor internal encoder.

2.9 HMI Alarm Display

Alarms are automatically displayed on the HMI display with their full description. To reset the alarm, touch the icon with the check mark in the lower right side of the screen Figure 23 for the interface. See Table 4 for list of alarms.

Figure 23: HMI Shown with Alarm Log

Table 4: List of Alarm Codes

No.	Status	Description
2	Motor Blocked	Motor blocked after exceeded attempts to move with 100% Torque
3	Invalid Position	Invalid position detected by the motor encoder/micro switch
7	Motor Temperature	Motor temperature above 75°C*
8	Communication	Motor communication failure*
9	Permissive	High voltage door open
10		Manual racking in progress

Note: *Only applicable to Smart version**

2.10 Connecting the portable HMI

The portable HMI is used to operate SIERS 2.0 racking system from up to 30 ft (9.1 m) from the equipment through a PROFINET cable that is connected to a port located on the front of the SIERS low voltage compartment or the front side of the SIERS control cabinet (see Figure 24 and Figure 25).

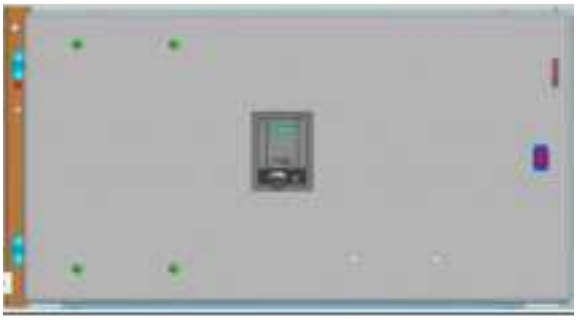


Figure 24: Port for PROFINET Cable Located in Front of SIERS Low Voltage Compartment

Figure 25: Port for PROFINET Cable Located in Front Side of SIERS Control Cabinet

2.11 Sequence of operation

Circuit breaker racking operation
The following describes the sequence of operation for racking the draw out circuit breaker. Following the safety guidelines and recommendations outlined in the safety section of this manual. Also, refer to the instruction manuals for specific switchgear: GM-SG non-arc-resistant switchgear (E50001-F710-A230-XX-XXXX) and GM-SG-AR arc-resistant switchgear (E50001-F710-A254-XX-XXXX) for additional information.

1. The following steps describe the operation sequence using the Local HMI Smart setup to rack a circuit breaker.

2. Locate the SIERS CPU and controls located in the designated low voltage compartment in the switchgear lineup or installed on the side wall of the indoor switchgear lineup in a control cabinet.

3. Plug in the PROFINET cable that is stored with the CPU and controls into the port located on the front of the SIERS low voltage compartment door or the on the front side of the SIERS control cabinet.

4. Ensure the CBM1, CMB2, and CBM3 miniature circuit breakers located inside SIERS control cabinet or compartment are switched ON.

5. Upon startup the HMI will display the upper and lower compartment selection screen as shown in Figure 32. Make your section selection based on the removable element you need to operate (see Figure 33).

IMPORTANT: *When first time operating SIERS, start with circuit breaker in the DISCONNECT position. On a de-energized lineup use the manual racking crank provided with the accessories to rack the removable element to the DISCONNECT position in the compartment.*

6. Starting with the circuit breaker in the DISCONNECT position.

7. Follow the instructions in the relevant GM-SG, GM-SG-AR switchgear instruction manual.

   a. The circuit breaker is now in the DISCONNECT position.

   b. The solid green indication (for DISCONNECT) on the HMI display will illuminate.

8. Ensure the main compartment door is closed and latched. If the door is not closed, SIERS will be disabled; and alarm will indicate on the HMI screen.

9. Touch TEST on the HMI touchscreen to initiate command to rack the circuit breaker to the TEST position. Note: It is not necessary to keep touching the screen. The circuit breaker will move to the TEST position.

10. When the circuit breaker begins to move, the green indication (for DISCONNECT) will turn off.

11. When the circuit breaker reaches the TEST position, the amber indication (for TEST) will turn on.

    a. In the TEST position, the secondary disconnects will mate, and the circuit breaker will now have control power.

    b. In the TEST position, the OPEN and CLOSE commands can be performed on the circuit breaker from the HMI touchscreen.

Figure 32: HMI Display showing compartment selection screen

Figure 33: HMI Display showing section selection in a lower compartment

12. To proceed to the CONNECT position, the circuit breaker must indicate OPEN on the HMI touchscreen. If the circuit breaker is not in OPEN status, SIERS will not allow racking to the circuit breaker to CONNECT position.

13. Touch CONNECT on the HMI display to rack the circuit breaker to the CONNECT position.

    Note: *It is not necessary to maintain constant pressure on the touchscreen. Upon initiating this command, the amber indication (for TEST) will turn off. When the* circuit breaker *reaches the CONNECT position, the red indication (for CONNECT) will turn on.*

14. When the circuit breaker is in the CONNECT position, it can be operated to CLOSE or OPEN from the HMI display.

15. To rack the circuit breaker from CONNECT to TEST or DISCONNECT, the circuit breaker must be tripped OPEN. The OPEN command can be initiated from the HMI touchscreen If the circuit breaker is not in OPEN status, SIERS will not allow racking to the circuit breaker from CONNECT to the TEST or DISCONNECT position.

Figure 26: HMI Displays Device in DISCONNECT (green Indication) Position

Figure 27: HMI Display in CONNECT (red indication) position

Figure 28: HMI Displays Device in TEST (amber Indication) Position

Auxiliary truck racking operation

The following describes the sequence of operation for racking voltage transformer, control power transformer, or fuse truck. Always refer the safety guidelines and recommendations outlined the safety section of this manual. Also, refer to the instruction manuals for specific switchgear: GM-SG non-arcresistant switchgear (E50001-F710-A230-XX-XXXX) and GM-SG-AR arc-resistant switchgear (E50001- F710-A254-XX-XXXX) for additional information.

Tip(s): *When control power is not available in the switchgear, then use 120 VAC power via external power outlet in the electrical room or area to operate SIERS 2.0 to remotely rack the auxiliary truck.*

The following steps describe the operation sequence using the HMI to rack an auxiliary truck.

1. Remove HMI from the control cabinet or compartment along with PROFINET cable.
2. Plug in the PROFINET cable stored with the CPU and controls into the port located on the front of the SIERS low voltage compartment door or the on the front side of the SIERS control cabinet.

   IMPORTANT: *When first time operating SIERS, start with auxiliary truck in the DISCONNECT position. On a de-energized lineup use the manual racking crank provided with the accessories to rack the auxiliary truck to the DISCONNECT position in the compartment.*
3. Starting with the auxiliary truck in the DISCONNECT position.
4. Follow the relevant instruction manual for GM-SG or GM-SG-AR switchgear.
   a. The auxiliary truck is now in the DISCONNECT position.
   b. The solid green indication (for DISCONNECT) on the HMI display will illuminate.
5. Ensure the auxiliary compartment door is closed and latched. If the door is not closed, SIERS will be disabled; and alarm will indicate on the HMI screen.

   IMPORTANT: *The molded-case circuit breaker must be OPEN, to disconnect secondary side of the CPT. Reference switchgear instruction manuals for instructions.*
6. Before racking an auxiliary truck with Control Power Transformer (CPT) or fuse rollout truck for a CPT, the secondary molded-case circuit breaker (MCCB) must be opened, and the key interlocked. Note: This step is not required for voltage transformer (VT) truck.
7. After step 6 above is performed, SIERS can be used to rack the auxiliary truck.
8. When the auxiliary truck begins to move, the green indication (for DISCONNECT) will turn off.
9. When the auxiliary truck reaches the CONNECT position, the red indication (for CONNECT) will turn on.
   a. The auxiliary truck is now in the CONNECT position and the molded case secondary circuit breaker can be turned on; for CPT or fuse truck, the secondary molded-case circuit can be turned on. Note: Follow the instructions in the relevant GM-SG or GM-SG-AR instruction manual.
10. To rack the auxiliary truck from CONNECT to DISCONNECT, the molded-case secondary circuit breaker must be opened and interlocked with the kirk key features (CPT rollout tray or CPT fuse rollout tray only).
11. For CPT or fuse truck, once the molded-case secondary molded-case circuit breaker is opened (turned off) and interlocked, SIERS can be used to rack the CPT or fuse truck to the DISCONNECT position.
12. Touch DISCONNECT on the HMI display. The auxiliary truck will move towards the DISCONNECT position.
13. The red indication (for CONNECT) will turn off. Once the auxiliary truck reaches the DISCONNECT position, the green indication (for DISCONNECT) will turn on.

2.12 Control Schematic

Schematic for Local HMI Smart Setup

The schematic diagram below, Figure 29, provides information on how the components and devices are interfaced to rack the removable elements and perform the close and trip operations with SIERS local HMI Smart setup.

2.13 Operation modes

During manual racking mode, SIERS is disabled when the manual racking crank is fully inserted onto the racking mechanism shaft activating the LS4 permissive switch. In electric racking mode, the manual racking crank should not be inserted. In electric racking mode, SIERS will perform the racking process.

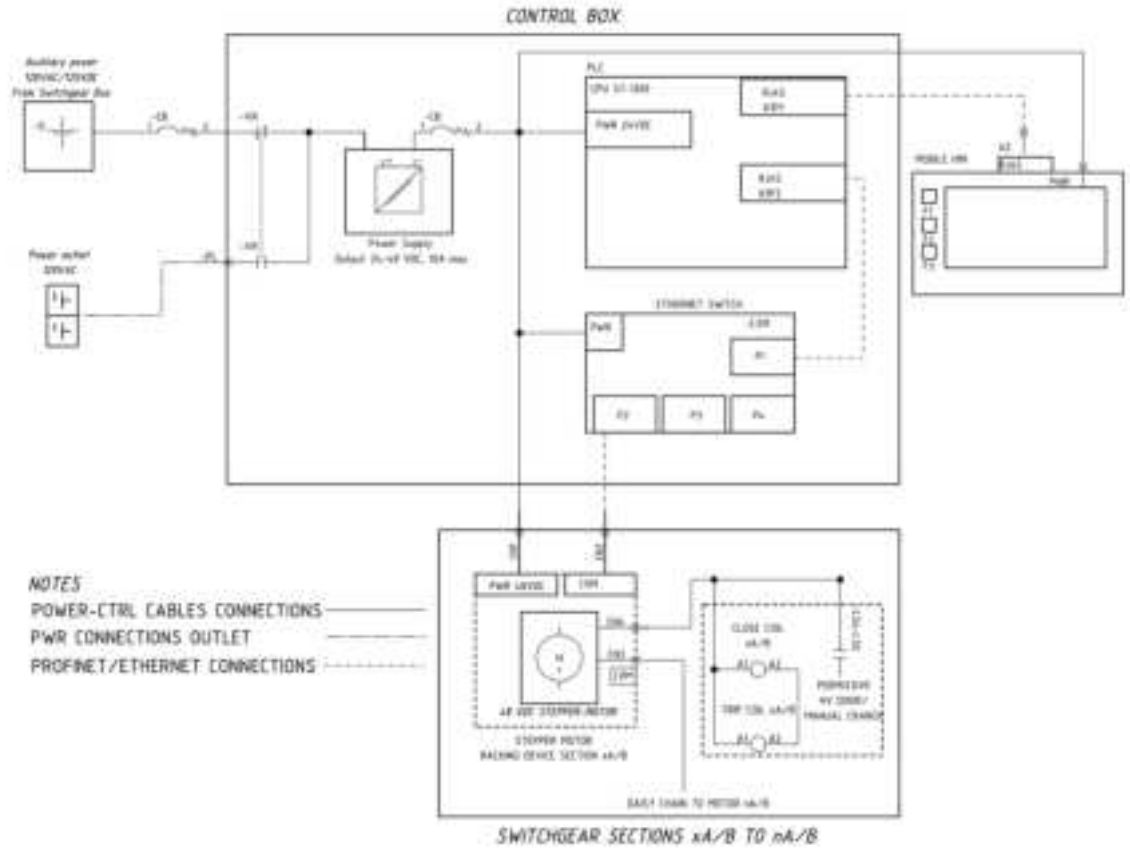


Figure 29: Schematic Diagram for Local HMI Smart Setup

SECTION 3.0

3.0 Alarms and Troubleshooting

3.1 Alarms

The SIERS 2.0 electrical racking system includes alarm functions to indicate unusual conditions. The alarms will raise on the HMI display under the conditions in Table 7 below:

Table 7: Alarm Modes and Descriptions

Alarm Mode	Alarm Description
Motor Overcurrent	When the overcurrent is detected, the motor sends the alarm indication to the PLC (CPU) and the HMI display will raise the over current text. This will stop the racking process. After a time of five seconds, the Logic of the CPU restarts the racking process to move the removable element to the DISCONNECT position. If this is unsuccessful, a second attempt to rack to the DISCONNECT position is initiated after a time of five seconds. If the second attempt is also unsuccessful, the CPU Logic disables electrical racking, and the user must use the manual racking crank to rack the removable element to the DISCONNECT position. If the motor over current is alarm is displayed, use the manual racking crank to manually rack the removable element to the DISCONNECT position following the instructions in the GM-SG or GM-SG-AR instruction manual. Verify that the removable element is in the DISCONNECT position. Unlatch and open the compartment door. Remove the removable element from the compartment, following all safety instructions and guidelines inspect the racking mechanism, e.g., alignment rails, and control system in the compartment to determine the source of the problem. Once the issue is found and corrected, reinsert the removable element, close and securely latch the compartment door, reset the alarm (by touching the acknowledge alarm text) and try the racking process again.
Motor Timeout	If the racking process takes more time that the system allows, SIERS 2.0 stops the racking process, and a time out alarm text is issued in the HMI display. Once the issue is found and corrected, reinsert the removable element, close and securely latch the compartment door, reset the alarm (by touching the acknowledge alarm text) and try the racking process again.
Open Permissive Switch	This error is caused by an open contact in one of the protection permissive switches. One permissive switch is for insertion of the manual racking crank. The second permissive switch is for an open compartment door. The third permissive switch is for sensing circuit breaker condition, which must be open to allow racking. Check that all three permissive switches are in the correct positions, that the circuit breaker is open, that the compartment door is closed, and the manual racking crank is not inserted. Then try the racking process again.
Removable Element or Auxiliary Tray Position “Unknown”	If none of the indicating status on the HMI display are on, and there is control power available, it means that the removable element is not in a defined position. The unknown position text will be displayed. Unlatch and open the compartment door, and remove removable element. Inspect the racking system, alignment rails, and control system in the compartment to determine the source of the problem. Once the issue is found and corrected, insert the removable element to the DISCONNECT position, and close and securely latch the compartment door. Then, use the manual operation method to rack the removable element to the desired position

3.2 Troubleshooting

The SIERS 2.0 electrical racking system includes troubleshooting tips are included the Table 8 below:

Table 8: Troubleshooting Tips

Troubleshoot	Possible Cause	Verification
HMI is not active	Power and or control connections are missing	Make sure the connection plug is connected to the HMI Box Verify the wiring for the power connections on the HMI
HMI active but commands not activating the racking operation	Racking device is not in a defined position Disconnect, test or connect No signal for removable elelment position is received Manual Lever for manual racking is inserted High voltage door is Open Motor temperature is equal or above 75°C	Verify the correct position by the HMI and the racking tape indication Verify the wiring connections Verify that no message alert is active Motor temperature should be below 75°C to proceed with operations
HMI active but not showing actual position of the removable element	Racking device is not in a defined position Disconnect, test or connect No signal for removable element position is received	Verify the correct position by the HMI and the racking tape indication Verify the wiring connections Verify that no massage alert is active
HMI active but command not closing or tripping the circuit breaker	Circuit breaker is in disconnect position No signal for circuit breaker status is received Circuit breaker roller for trip free is active	Verify the required conditions to perform the Close / trip functions * Circuit breaker Open / Closed * Circuit breaker in Test or connect position Verify the wiring connections Verify that no massage alert is active Make sure the trip free roller is operating correctly
Communication failure Massage is active	Ethernet Communication cable broken or missing from Connection box to PLC Ethernet Communication cable broken or missing from Motor to Ethernet switch Communication broken or missing from HMI to PLC	Review the communication diagram Install and or connect the missing communication cable
During operation motor stops	Mechanical Interference of the removable element Time exceeded between positions Motor temperature exceeded 75°C Power supply interrupted Manual operation detected High voltage door opened	Inspect for any mechanical interference in the removable element or racking mechanism Perform manual operations to verify the correct movement of the racking device Motor temperature shall be below 75°C for operation The rated power supply must be maintained during racking operations Verify no massage alert is active

3.3 Smart Motor Details

Features

Features of the motor used in the Local HMI Smart setup are included the Table 9 to the right:

Table 9: Features of Smart Motor used in Local HMI Smart setup

Features
Closed-loop operation
Absolute multiturn encoder
High resolution 409600 cnt/rev
Speed 0 – 3000 In 0.01 RPM steps
Wide supply range 7-7 2 Vdc
Protection class up to IP65
Connectors: M12 Industrial

Connections

Connections of the motor used in the Local HMI Smart setup are included the Figure 30 below.

Figure 30: Interface and Connections for Smart Motor

Indicators

The smart motor is equipped with indicators used for troubleshooting and testing. See Figure 31 for details.

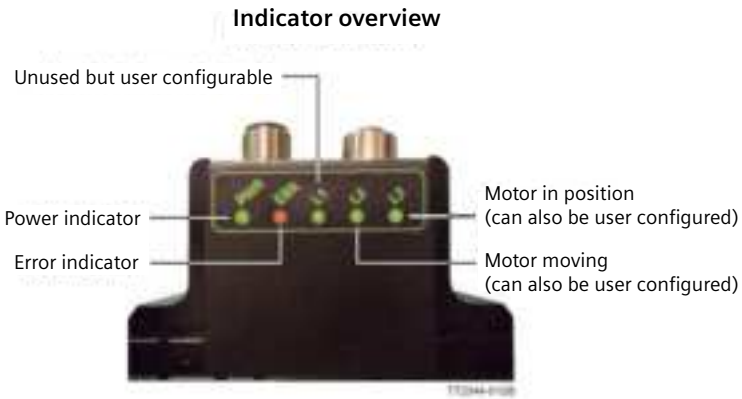


Figure 31: Indicator Layout on the Smart Motor

Table 10: Features of Smart Motor used in Local HMI Smart setup

LED indicator descriptions (default setup)

LED Text	Color	Constant off	Constant on	Blinking
L1	Green	Default	Only when user configured	Only when user configured
L2	Green	Motor not moving	Motor moving	–
L3	Green	Motor not in position	Motor in position	–
ERR	Red	No error	–	Error
PWR	Green	Power is not applied	Power is applied to both motor and module. The LED will lite red constantly if the supply is too low.	–

3.4 Spare Parts

The following Table 11 provides a list of recommended spare parts.

Table 11: Spare Parts

Item	Description	Siemens Part No.
1	Step Motor 12-75Vdc with planetary Gear box	A7ERGX000605093
2	Brushless DC motor, 75VDC	A7ERGX000605012
3	Power Cable M12 5pin, 5m, M12 Shl Cable 5m 5 pin Fem 0°, Power	A7B91501356318
4	Communication cable M12 17 PIN 5M, M12 SHL CABLE 5M 17P MAL 0°	A7B91501356319
5	M12 4 Position D code SF/UTP,Category 5E	A7B91501356412
6	M12 4 Position D code SF/UTP Industrial cable, Category 5E , M12 M /RJ45, 10M	A7B91501357364
7	SIMATIC HMI connecting cable 15m	6AV21815AF100AX0
8	Relay Module, Enclosed Power Relay Heavy 24 V DC @ 30A	3TX71314DC03
9	Auxiliary Relay, 2NO/2NC, 120VAC 60 Hz Coil	3RH21221AK60
10	Roller Micro Switch LS1-LS5	A7ERGX001929013

SECTION 4

Disposal

Siemens equipment is an environmentally friendly product predominantly consisting of recyclable materials. For disposal, some disassembly, separation, and professional services handling may be required.

Materials to be handled include but are not limited to:

- *Metals:* Should be transferred and recycled as mixed scrap metals.
- *Plastics:* Plastic containing a recycle symbol should be recycled. Plastic lacking the recycle symbol should be discarded as industrial waste.
- *Small electronics, insulated cables, and motors:* Should be recycled via electronics scrap disposal companies specialized in separating and sorting as described above.
- *Batteries:* Should be recycled via a recycling company.

Disposal regulations vary from locality to locality and may be modified over time. Specific regulations and guidelines should be verified at the time of waste processing to ensure that current requirements are being fulfilled. For specific assistance in understanding and applying regional regulations and policies or manufacturer's recommendations, refer to the local Siemens service representative for additional information.

⚠ WARNING

Stored energy.

Can cause death, serious injury, or property damage.

Mechanisms contain stored energy, which may be released during disassembly.

Wear suitable protection and take appropriate precautions when disconnecting and removing moving parts.

⚠ WARNING

Heavy objects.

Can cause death or serious injury.

Disassembly may cause an unbalanced load, and could result in falling objects.

Take appropriate precautions in a properly designated workspace to maxmize support and stability.

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English

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