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NHP

TemRack *iR*

Integrated Remote Racking Device

Minimise your risks, maximise your safety

USER MANUAL

Version

1.2.4

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Using this manual

Safety precautions

Authorised personal only
The product or system described in this documentation must be installed, operated and maintained by qualified personnel only. NHP or Terasaki accept no responsibility for the consequences of the use of this equipment by unqualified personnel.
A qualified person is one with the necessary skills and knowledge of the construction and operation of the installation of electrical equipment and has been trained to identify and avoid risks.

Appropriate use of NHP / Terasaki products
NHP / Terasaki products are intended to be used only for the applications described in the catalog and technical documentation, which is dedicated to them.
If products and components from other manufacturers are used, they must be recommended or approved by NHP or Terasaki.
Appropriate use of NHP / Terasaki products during transport, storage, installation, assembly, commissioning, operation and maintenance is necessary to ensure safe operation and without any problems.
The permissible ambient conditions must be met. The information contained in the technical documentation must be observed.

Publication of responsibility
The contents of this document have been reviewed to ensure that the reliability of the information is correct at time of publication.
NHP or Terasaki are not responsible for printing or damage resulting from errors. NHP or Terasaki reserve the right to make corrections and changes needed in subsequent edition.

Warnings and notes
This documentation contains safety instructions that you must follow for your personal safety and to prevent damage to property.
Safety instructions, referring to your personal safety are reported in the literature by a safety alert symbol.

Safety warning symbols and the words below are classified according to the degree of risk.

WARNING: Indicates an imminently hazardous situation which, if it can not be avoided, will result in death or serious injury.

WARNING: Indicates a potentially hazardous situation which, if it can not be avoided, can result serious injury or death.

WARNING: Indicates a potentially hazardous situation which, if it can not be avoided, may cause minor or moderate injury.

Notice: Indicates a warning of property damage and can also indicate important operating and especially useful information on the product, that it should pay particular attention to efficient and safe operation.

Summary of Changes

This section highlights the details of changes made since the previous issue of this document.

The versioning convention used to track changes in this document follows the structure V**x.y.z** where:

x: Major revision, where extensive changes are made which is generally incompatible with the previous version. Such changes may include new products and/or features, or removal of information which is no longer relevant or applicable to the previous version

y: Minor revision, where changes made do not change the overall scope of the previous version, but may include additional information which complements or corrects the previous version, or provides additional clarity on an existing topic.

z: Patch version, where small changes are made to correct minor errors or adjust existing text, charts, figures and/or images, and which do not add or remove information from the previous version. Example changes may include spelling corrections, image re-sizing and adjustments, updated images, etc.

Version	Publication date	Changes	By
V1.0.0	2-Feb-2022	Initial release	D.NAT
V1.0.1	16-Mar-2022	Wiring – corrected ACB Auxiliary contact arrangement	D.NAT
V1.1.0	27-Apr-2022	Commissioning – ACB body and carriage alignment. Commissioning – Cycle Counter	D.NAT
V1.2.0	29-Sep-2022	Updated product images – formatting – additional warning on personnel present in switch room	D.NAT
V1.2.1	4-Oct-2022	Insert Notes section, extra blank pages for binding	D.NAT
V1.2.2	9-Feb-2023	Corrected labelling on example wiring diagram	D.NAT
V1.2.3	17-May-2023	Modified remote rack to TEST/ISOLATE procedure for opening ACB contacts manually	D.NAT
V1.2.4	9-Jun-2023	Added notice about potential ACB body unthreading issue and instructions for repeating steps if needed.	D.NAT

Table of Contents

Introduction

The TemRack *iR* is a fully integrated automated motorised racking device, which enables remote racking of the Terasaki TemPower 2 AR Air circuit breaker (ACB) body into and out of its associated carriage. The automated racking function permits safe isolation of the ACB with zero physical interaction between personnel and the ACB.

This user manual describes the TemRack *iR* features and instructions for use and provides useful information for commissioning, troubleshooting, and maintenance of the ACB racking system.

Who should use this manual?

This manual aims to provide users, electricians, panel builders and maintenance personnel, with the technical information required for commissioning and operation of the NHP/Terasaki TemRack *iR*.

Users of this document must have at minimum a basic understanding of electrical circuit protection topics including (but not limited to):

- Power distribution and reticulation
- Circuit protection devices
- Fault currents
- Arc faults
- Incident Energy

WARNING: The TemRack *iR* features in-built safety features to prevent automated racking whilst the ACB is in the CLOSED/ON position. Incorrect installation or misuse can result in serious damage to equipment and personal injury or death.

To ensure correct operation, the TemRack *iR* must only be installed and commissioned by NHP Service technicians and/or authorised personnel

WARNING: The TemRack *iR* should be operated with clear view of the ACB and surrounding area, ensuring no personnel are nearby during operation.

Only authorised personnel shall be permitted in the vicinity of the ACB during operation of the TemRack *iR* and must do so under strict safety procedures, which may include (but not limited to) maintaining an adequate safe distance and appropriate protective clothing.

Risk of serious damage to equipment and personal injury or death due to arc flash hazard.

Introduction

Additional resources

The following resources contain additional information which should be read in conjunction with this document.

Resource	Description
NHP/Terasaki TemPower 2 AR ACB Installation Manual AR- IN-008-EN	Information on installing, mounting, and wiring the TemPower 2 AR ACB

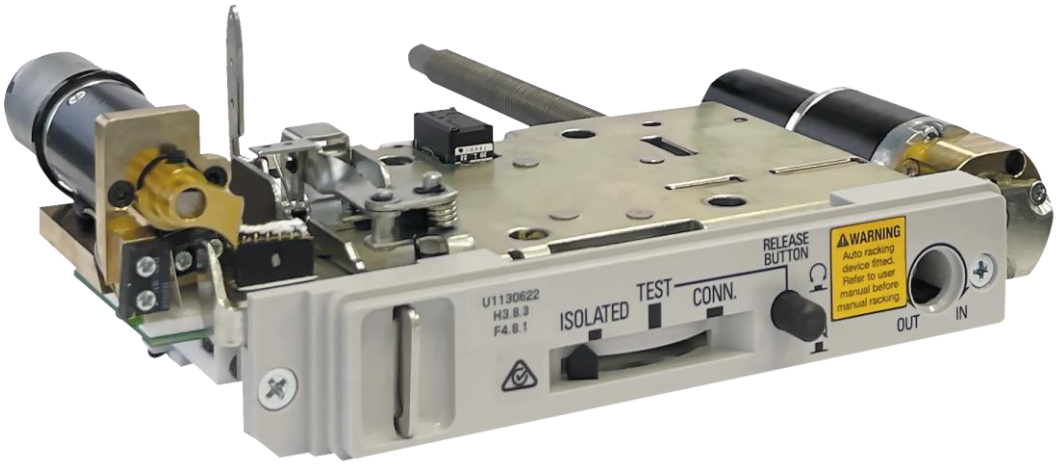
Terminology and abbreviations

Abbreviation	Description	Abbreviation	Description
A	Amperes	**LCS**	Local Control Station used to send commands to the ACB and racking unit from a remote location
ACB	Air Circuit Breaker	**LRC**	Latch release coil
CONNECT	In this position the main circuit and the control circuits are connected for normal service	**OCR**	Overcurrent release unit
DC-37	D-Subminiature (D-sub) connector – 37-pin	**PCB**	Printed circuit board
I/O	Input / Output connections for interfacing with the TemRack *iR*	**PSU**	Power supply unit
IDC	Insulation-displacement contact	**SHT**	Shunt trip device
iR	Integrated racker	**TEST**	In this position the main circuit is isolated, and the control circuits are connected. The ACB can be tested with the switchboard door closed
iRRD	Integrated remote racking device	**V**	Volts
ISOLATE	In this position, both the main circuit and the Terasaki control circuits are isolated. (TemRack *iR* control and power remains live in this position, unless otherwise isolated separately)		

Product Information

The TemRack *iR* is a fully integrated automated motorised racking device, which enables remote racking of the Terasaki TemPower 2 AR Air circuit breaker (ACB) body into and out of its associated carriage. The automated racking function permits safe isolation of the ACB with zero physical interaction between personnel and the ACB. Separation of personnel and possible point of arc flash minimises risk of exposure for operators and is becoming a common safety practice for racking procedures.

It features integrated digital I/O for control and feedback, allowing the operator to remotely open or close a Terasaki ACBs and rack units in or out whilst located outside the switch room. Remote control may be performed via a local control station (LCS), or other remote methods utilizing the integrated I/O. This user manual describes operation using the standard LCS interface.



Features

- Zero physical interaction between personnel and the Terasaki ACB
- Completely motorised with zero manual intervention
- Easy control with intuitive design
- Housed completely within the Terasaki ACB body with no protruding components
- Integrated in the ACB body for easy maintenance away from live switchboards
- Retrofittable to existing installations
- Safely perform switchgear operations remote from the switchboard
- Eliminate risk of exposure to explosive arc fault events and high incident energy

Frame Sizes

- AR2
- AR3
- AR4

Protection Functions

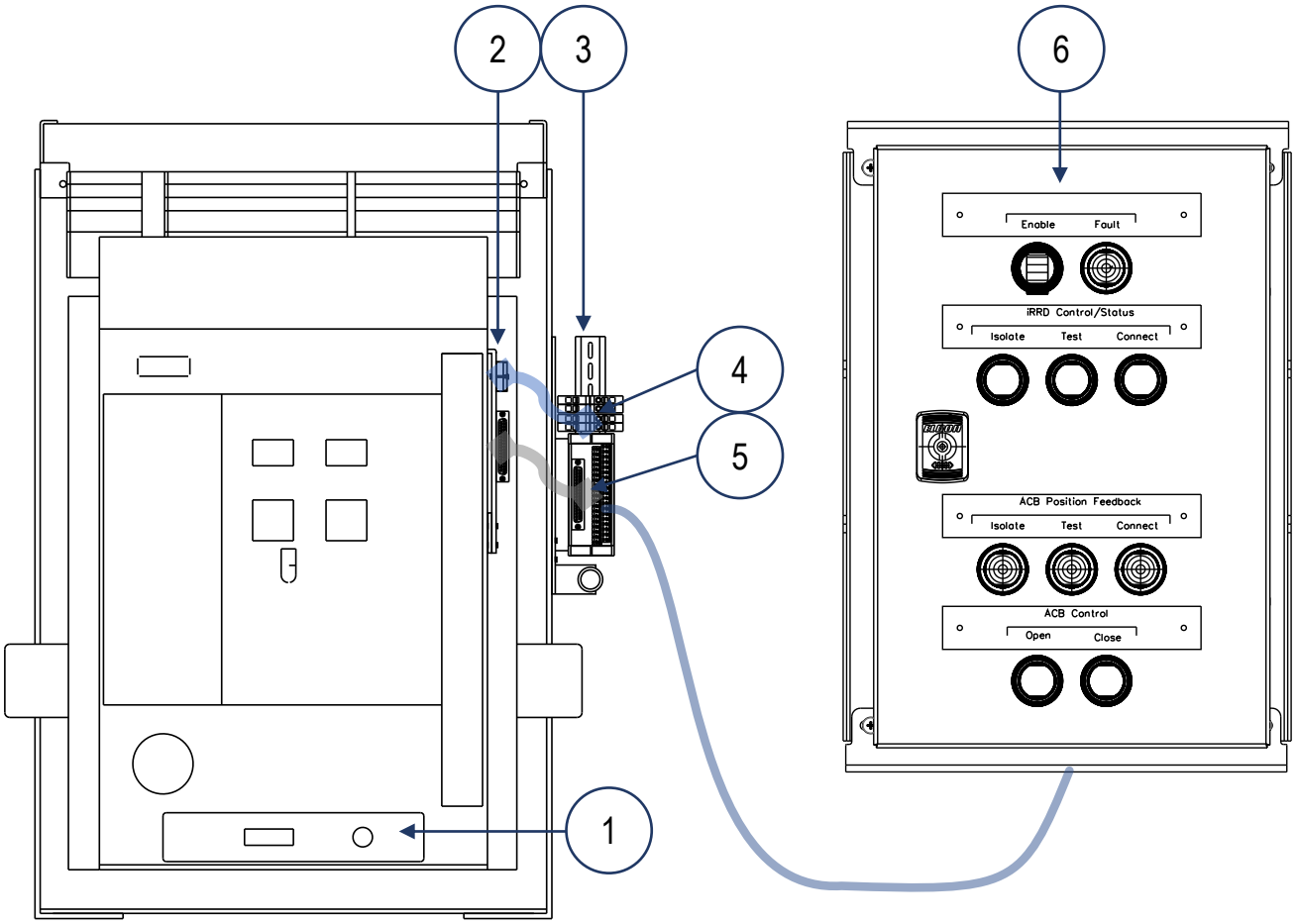
- Reduce risk of exposure to dangers of arc flash events by locating personnel away from the switchgear
- Remote Racking
- Remote Isolation

Product Information

TemRack *iR* system overview

The TemRack *iR* system is an assembly that is installed and commissioned by NHP Service that can be installed into new switchboards or retrofitted to existing switchboards. The ACB body is supplied with the TemRack *iR* device pre-installed along with the ACB body bracket with wiring loom and connectors. The ACB carriage requires the ACB carriage bracket to be installed, which can be supplied pre-installed by NHP Service, or installed on-site by an NHP Service technician for existing installations.

The supplied cables are used to connect the ACB body bracket connectors to the ACB carriage connectors and terminals.
From the ACB carriage connectors, the TemRack *iR* may be interfaced using the supplied standard LCS, or other remote-control methods (e.g., custom LCS or controlled from an automation system interfacing to the I/O).



Number	Description
1	TemRack *iR* integrated remote racking device
2	ACB body bracket assembly
3	ACB carriage bracket assembly
4	Anderson connecter cable for control power
5	D-Sub 37-pin cable for control signals
6	Optional Standard Local Control Station (LCS)

Product Information

Technical data

Frame / Model	Unit	Condition	AR2	AR3	AR4
Nominal voltage ratings					
Nominal operating voltage	(V)	dc	24	24	24
Absolute operating voltage range	(V)	dc	21... 27	23 ... 27	21 ... 27
Nominal current ratings					
Peak operating current	(A)	dc	2.50	5.00	4.20
Mechanical ratings					
Duty cycle[1][2]	(Op / min)	@ 25°C	5 / 20	5 / 20	5 / 20
Ambient temperature	(°C)		-5 ... 50	-5 ... 50	-5 ... 50
Maintenance schedule[3] (number of operations)	(Op)		100	100	100
Operating modes					
Motorised:					
Test → Connect			Yes	Yes	Yes
Isolate → Connect			Yes	Yes	Yes
Connect → Test			**No**	**No**	**No**
Test → Isolate			Yes	Yes	Yes
Connect → Isolate			Yes	Yes	Yes
Isolate → Remove			Yes	Yes	Yes
Manual					
All positions			Yes	Yes	Yes

(1) Duty cycle is defined as number of racking operations per time period. i.e., 5 / 20 = 5 operations per 20-minute period.
(2) One operation is a single racking operation between any two defined positions (e.g., rack from ISOLATE to CONNECT)
(3) Maintenance should be performed within the number of operations quoted, or at least once per 12-month period, whichever comes first.

Installation

Precautions

WARNING: The TemRack *iR* is an internal accessory to the TemPower 2 AR ACB. To reduce the risk of electrical shock and damage to equipment, the power source upstream of the ACB should be disconnected and isolated before installation or servicing of the ACB and its associated accessories.

Notice: To ensure correct performance, and integrity of equipment, the installation instructions and recommendations provided herein shall be respected. Refer to the respective user manual and installation instructions provided with the ACB and its associated accessories.

Power Supply

The TemRack *iR* requires an external power supply to operate. An external 24Vdc Power Supply Unit (PSU) should be selected to allow for the maximum current draw of the TemRack *iR* as well as any other ACB accessories which may be in use, and which require the same power source.

Other accessories which may utilise the same 24Vdc power source may include (but are not limited to):

- Spring-charge motor
- Shunt trip device (SHT)
- Latch release coil (LRC)
- Overcurrent Release unit (OCR)
- Auxiliary and feedback contacts

The maximum current draw of the TemRack *iR* occurs during the racking operation towards *Connect* whereby the ACB body contact clusters engage the carriage busbar. This current draw is dependent on the ACB frame size due to different contact cluster sizing and arrangements. Refer to the Technical Data section for peak current draw for the relevant ACB frame size.

The TemRack *iR* may be operated over a limited range of voltages depending on the ACB frame size, with 24V dc being the nominal value. Consideration must be given to any voltage drop which may occur in the wiring between the PSU and the TemRack *iR* interface terminals. Voltage drop is dependent on several factors including cable distance, conductor material and type, conductor cross-sectional area, instantaneous current draw, as well as environmental factors such as temperature, humidity, cable layout and enclosure, etc. Refer to AS/NZS 3008 for information and methodology on cable selection.

Example voltage drop calculation for AR3 frame size:

Conductor type		2.core copper, stranded
Cross section		2.5mm^2
Cable distance	D	20m
Conductor resistance	R	7.41Ω/km
Peak current	A	5.0A

$$V_{drop} = \frac{2 \times D \times R \times A}{1000} = \frac{2 \times 20 \times 7.41 \times 5.0}{1000} = 1.48\ V_{dc}$$

In the above example, the voltage produced at the TemRack *iR* interface terminals is reduced by 1.48V. If the PSU on the other end of the cable was set to 24Vdc, then the effect voltage available is only 22.52 V, which is insufficient to run the TemRack *iR* (minimum 23Vdc for the AR3 frame size)

In this case, it would be strongly recommended to (either or a combination of) shorten the distance to the PSU, increase the conductor size (and thus reduce conductor resistance) or, if possible, boost the PSU voltage to a higher output voltage; ensuring that the voltage available to the TemRack *iR* is within its absolute operating voltage range during racking operations at peak current draw.

Refer to the Technical Data section for the absolute operating voltage range for the relevant ACB frame size.

Installation

Wiring

Connection and interfacing to the TemRack *iR* are made via the supplied body and carriage mounted brackets and wiring looms.

On the ACB body-mounted bracket, there are two provided connectors:

1. 2P Anderson connector – used to provide dedicated 24Vdc power to the TemRack *iR* PCB and motors.
2. D-sub 37-pin connector (DC-37) – used to provide signalling and control to the TemRack *iR*, and additional I/O for future expansion of the TemPower2 ACB OCR and internal accessories.

On the ACB carriage-mounted bracket, there are:

1. Terminals for the 24Vdc power supply and other terminals as specified for the installation
2. D-sub 37-way breakout board, which provides tunnel terminals for easy termination to the individual cables of the DC-37 wiring loom for remote or local control.

Notice: The terminals provided on the ACB-carriage bracket are dependent on the ACB and TemRack *iR* project specification. At minimum a pair of standard terminals are provided for 24Vdc power, however these may be accompanied by additional terminals and associated control gear as dependent on the user specification. Contact NHP Service for further detail and customisable options.

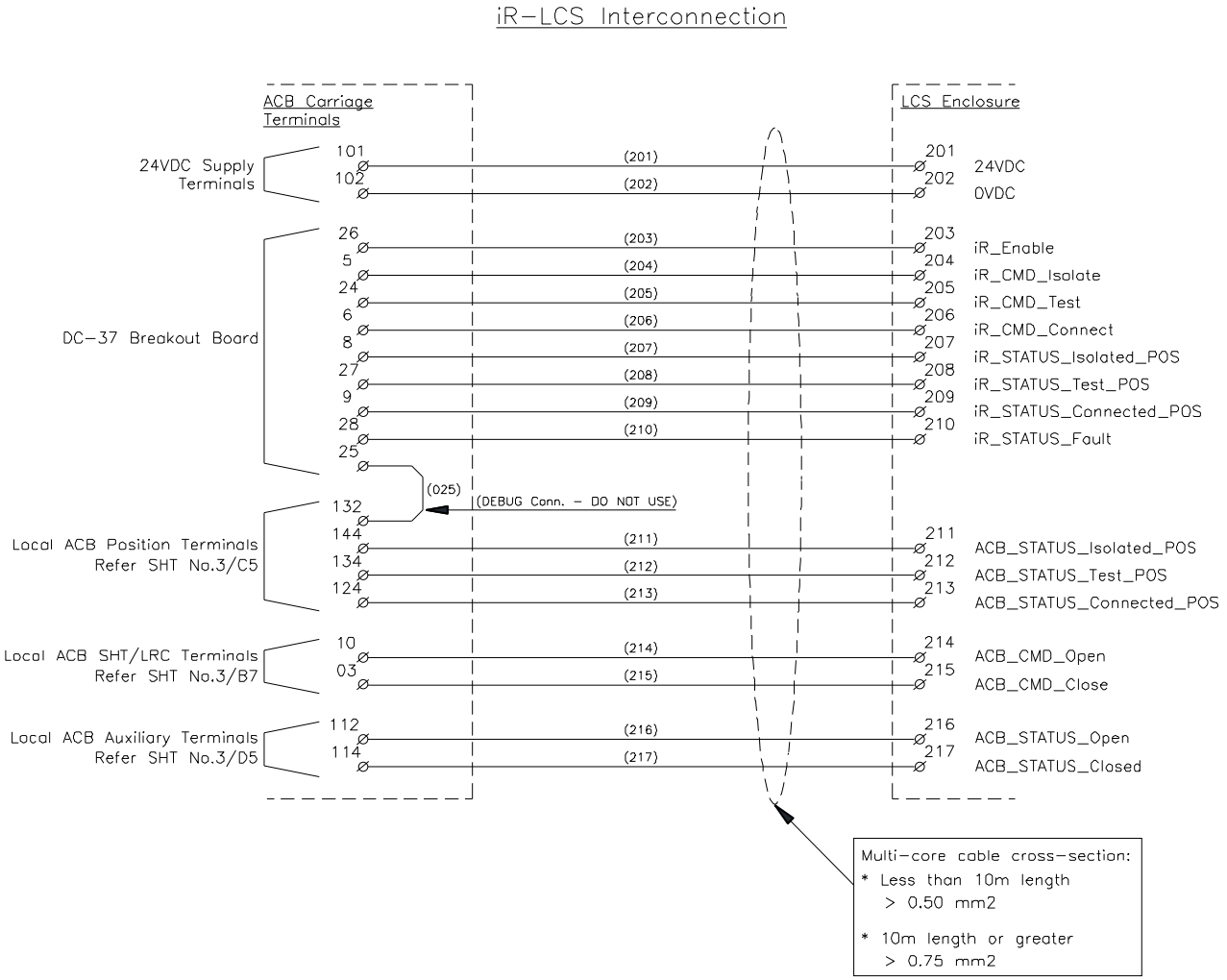
Additional wiring to the LCS and other ACB interfacing is provided via the standard ACB carriage terminals. Refer to the TemPower2 ACB Installation Manual for further detail on the use of these terminals.

The standard LCS utilises the ACB body position indicators to provide redundant feedback of the position of the ACB body. Detail pertaining to these terminals are provided in the wiring diagrams shown in this document.

Installation

Wiring

ACB carriage bracket terminals



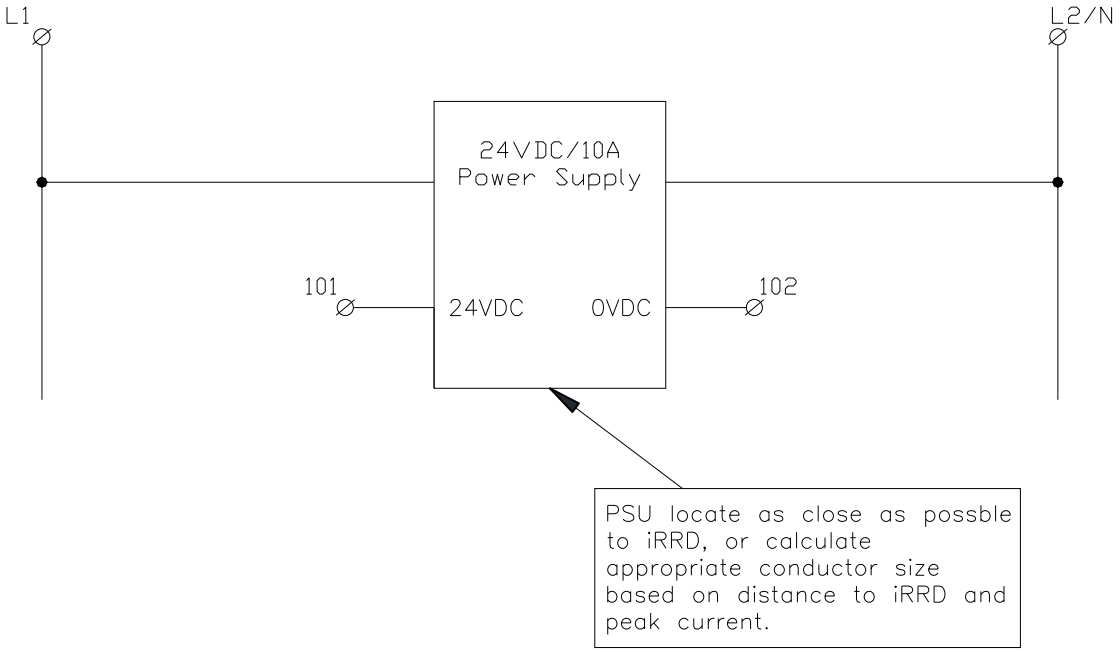
Location	Terminal number	Input/Output	Description
Side bracket terminals	101	Input, +24v dc	+24 vdc power supply to TemRack *iR*
	102	Input, 0v dc/COM	0 vdc power supply to TemRack *iR*
Side bracket DC-37 Breakout Board	26	Input, 24v dc source	ENABLE signal
	5	Input, 24v dc source	ISOLATE position command
	24	Input, 24v dc source	TEST position command
	6	Input, 24v dc source	CONNECT position command
	8	Output, 24v dc source	ISOLATE position status output from TemRack *iR*
	27	Output, 24v dc source	TEST position status output from TemRack *iR*
	9	Output, 24v dc source	CONNECT position status output from TemRack *iR*
	28	Output, 24v dc source	FAULT status output from TemRack *iR*
	25	Input, 24v dc source	TEST position status input to TemRack *iR* from ACB TEST status (Optional/Reserved)
ACB Carriage Position terminals	132	Output, volt-free contact N/C	TEST position status output from ACB (Optional/Reserved)
	144	Output, volt-free contact N/O	ISOLATED position status output from ACB
	134	Output, volt-free contact N/O	TEST position status output from ACB
	124	Output, volt-free contact N/O	CONNECT position status output from ACB
ACB Carriage SHT/LRC terminals	10	Input, 24v dc source	ACB Shunt trip device, energise to OPEN contacts
	03	Input, 24v dc source	ACB Latch-release coil, energise to CLOSE contacts
ACB Carriage Auxiliary terminals	112	Output, volt-free contact	ACB contacts OPEN status
	114	Output, volt-free contact	ACB contacts CLOSED status

Installation

Wiring

DC power supply

Notice: The PSU wiring diagram shown below is for illustrative purposes and is an example only. The type and sizing of the PSU is dependent on the application and the frame size of the ACB. Refer to Installation – Power Supply section for sizing requirements.

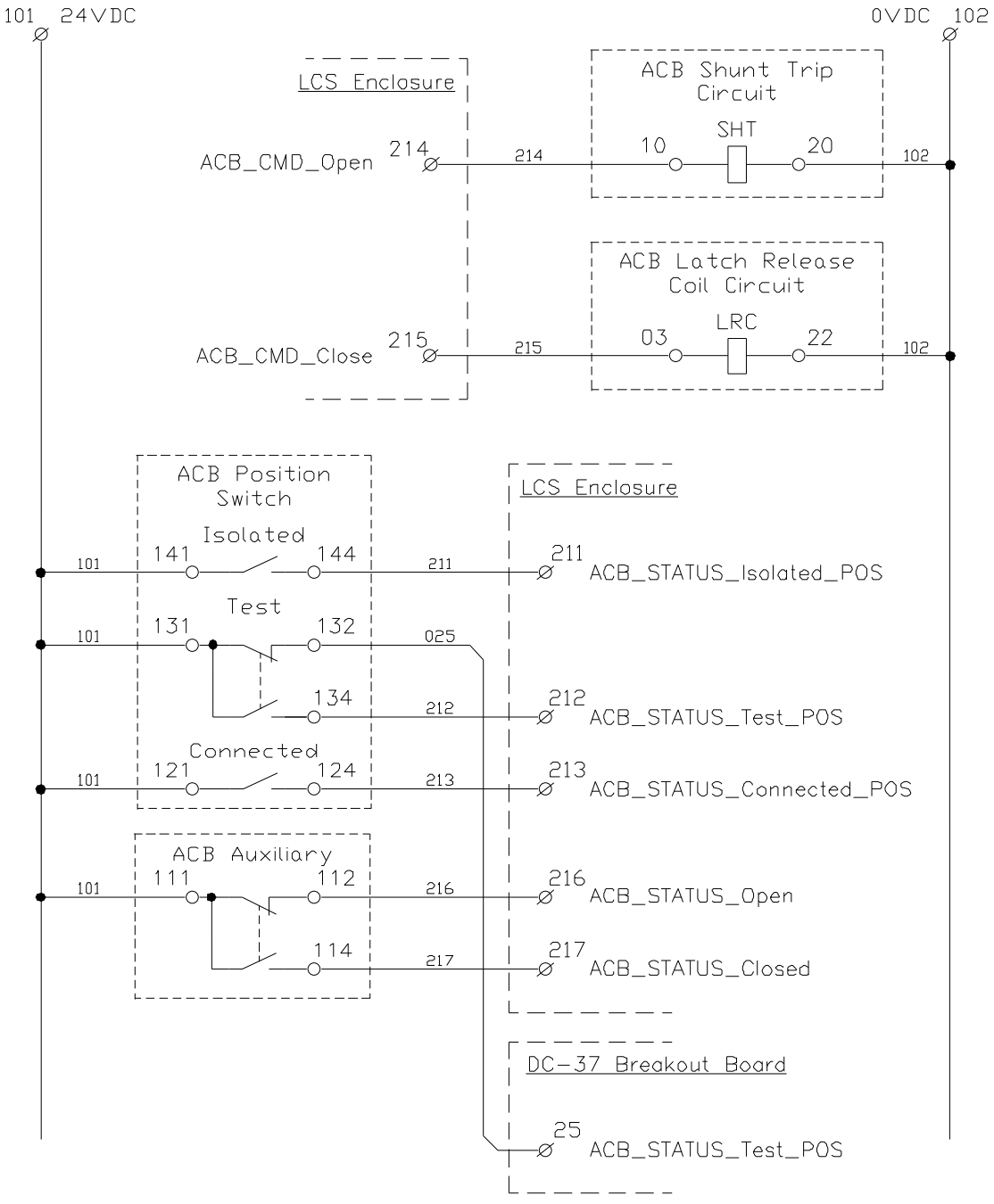


Installation

Wiring

ACB control

> **Notice**: The ACB Control wiring diagram shown below is an example for illustrative purposes where the standard LCS is in use. It does necessarily not include the wiring to alternative remote-control methods or to optional accessories which may or may not be present for the specific ACB application. For example, wiring to the electronic OCR, or spring-charge motor. Refer to the NHP/Terasaki TemPower 2 AR ACB Installation Manual for further detail.



Commissioning

The commissioning of all new and retrofitted TemRack *iR* racking systems for first time use must be carried out by NHP Service as part of the warranty conditions. The commissioning is carried out on site by the NHP Service technician for the ACB body and associated carriage. Spare ACB bodies with the TemRack *iR* pre-fitted may be kept on site as critical spares for fast replacement by authorised site personnel, however the spare ACB body with the TemRack *iR* racking system must also go through the initial commissioning procedure by NHP Service for the target switchboard. Once the TemRack *iR* system is commissioned by NHP Service and has a commissioning report completed, spare pre-tested ACB bodies with the TemRack *iR* system can be swapped out by authorised personnel on site.

This section describes the steps required to ensure correct operation of the TemRack *iR* system if replacing an existing TemRack *iR* fitted ACB with a spare pre-tested TemRack *iR* fitted ACB.

Refer to Removing ACB body from carriage and Inserting ACB body to carriage sections respectively.

Once the new ACB body has been inserted and all cables and connectors have been fitted, the following commissioning steps must be performed.

Product serial number and version

Record the serial number and version numbers printed on the front of the TemRack *iR*, which can be found on the front label.

- Serial number (e.g., U1240221)
- Hardware Version (e.g., H4.4.3)
- Firmware Version (e.g., F4.5.1)

ACB body and carriage alignment testing

WARNING: Manual racking must only be performed by authorised personnel under strict safety procedures. Risk of severe personal injury and/or equipment damage due to arc flash hazards and exposed moving parts.

WARNING: Ensure that the TemRack *iR* is disabled by removing the *Enable* signal, and/or isolating power supply to the TemRack *iR* before inserting the manual racking handle to avoid risk of unexpected startup.

WARNING: Manual racking should only be performed as part of the ACB body insertion and commissioning processes and/or for emergency use. Risk of damage to the TemRack *iR* and associated mechanical components. Special care must be taken whilst turning the manual racking handle to maintain a constant rotation speed. Do not use sudden and jerky movements when operating the manual racking handle.

Alignment testing is performed with the ACB body inserted, with no power applied to the TemRack *iR* or additional powered components of the ACB (i.e., spring charge motor). This test ensures there are no mechanical anomalies with the ACB body and carriage which would otherwise prevent a smooth and successful racking operation.

Refer to the NHP/Terasaki TemPower 2 AR ACB Installation Manual for detailed instructions for manual racking.

If at any point the ACB body does not successfully rack into the desired position. Remove the ACB body from the carriage, inspect and correct for any mechanical issues

.

Commissioning

ACB body and carriage alignment testing

Manual rack to TEST

STEP 1: Ensure there is no power applied to the TemRack *iR*, the *Enable* selector is in the OFF position (Refer Enabling the TemRack *iR* section), and the ACB contacts are OPEN.

STEP 2: Insert the manual racking handle into insertion point of the TemRack *iR* and gently rotate clockwise. Maintain a constant rotation speed. Do not use sudden and jerky movements when operating the manual racking handle.

STEP 3: Observe the ACB body moving into the carriage towards the TEST position. Monitor for any mechanical issues which inhibit racking.

STEP 4: When the TEST position is reached, the manual racking handle will seize, and further rotation is prevented.

STEP 5: Ensure position indicator flag on the front of the TemRack *iR* is in the TEST position.

Manual rack to CONNECT

STEP 1: Press the test-release button next to the insertion point of the manual racking handle. The test-release button should push in easily. If not , turn the manual racking handle counter-clockwise slightly to loosen the test-release button and attempt the push in again.

STEP 2: With the test-release button pushed in, continue to gently turn the manual racking handle clockwise. Maintain a constant rotation speed. Do not use sudden and jerky movements when operating the manual racking handle.

STEP 3: Observe the ACB body moving further into the carriage out of the TEST position and towards the CONNECT position. Monitor for any mechanical issues which inhibit racking.

STEP 4: When the CONNECT position is reached, the manual racking handle will seize, and further rotation is prevented.

STEP 5: Ensure position indicator flag on the front of the TemRack *iR* is in the CONNECT position.

Manual rack to ISOLATE

STEP 1: Gently turn the manual racking handle counter-clockwise. Maintain a constant rotation speed. Do not use sudden and jerky movements when operating the manual racking handle.

STEP 2: Observe the ACB body moving outward from the carriage out of the CONNECT position and towards the TEST position. Monitor for any mechanical issues which inhibit racking.

STEP 3: When the TEST position is reached, the manual racking handle will seize, and further rotation is prevented.

STEP 4: Press the test-release button next to the insertion point of the manual racking handle. The test-release button should push in easily. If not , turn the manual racking handle clockwise slightly to loosen the test-release button and attempt the push in again.

STEP 5: With the test-release button pushed in, continue to gently turn the manual racking handle counter-clockwise. Maintain a constant rotation speed. Do not use sudden and jerky movements when operating the manual racking handle.

STEP 6: Observe the ACB body moving further outward from the carriage out of the TEST position and towards the ISOLATE position. Monitor for any mechanical issues which inhibit racking.

STEP 7: Continue to rotate the handle until the position indicator flag on the front of the TemRack *iR* is in the ISOLATE position.

Commissioning

Base functionality testing

Functional testing is performed with the ACB body inserted, 24Vdc power applied, and the *Enable* selector switch to the ON position.

Enable signal and indicators

Test that the Enable signal can be cycled and that all LCS indicators are functional

STEP 1: Ensure 24Vdc power is applied to the TemRack *iR*.

STEP 2: Turn the *Enable* selector switch to the ON position (Refer Enabling the TemRack *iR* section).

STEP 3: Observe the Enable, Fault, ISOLATE, TEST and CONNECT indicators all illuminate in sequence, and then turn off. The remaining indicators should be Enable and ISOLATE, representing that the ACB is in the ISOLATE position, and the TemRack *iR* is enabled.

STEP 4: Turn the *Enable* selector switch to the OFF position.

STEP 5: Observe the Enable, Fault, ISOLATE, TEST and CONNECT indicators are all OFF.

STEP 6: Repeat STEP 2 and STEP 3 to ensure the Enable signal can be cycled.

ISOLATE position

Test that the TemRack *iR* and associated LCS correctly indicate the ISOLATED position.

STEP 1: Ensure LCS LED status indicators show ACB in ISOLATE position and contacts are OPEN.

STEP 2: Ensure position indicator flag on the front of the TemRack *iR* is in the ISOLATED position.

Rack to TEST

Test that the TemRack *iR* is capable of remote racking towards the TEST position from ISOLATE, and that all status indicators operate correctly.

STEP 1: Issue a command to rack to the TEST position. (Refer Remote racking to TEST section).

STEP 2: When racking is completed, ensure LCS LED status indicators show ACB in TEST position and contacts are OPEN.

STEP 3: Ensure position indicator flag on the front of the TemRack *iR* is in the TEST position.

Rack to CONNECT

Test that the TemRack *iR* is capable of remote racking towards the CONNECT position from TEST, all status indicators operate correctly, and that the ACB contacts can be closed.

STEP 1: Issue a command to rack to the CONNECT position. (Refer Remote racking to CONNECT section).

STEP 2: When racking is completed, ensure LCS LED status indicators show ACB in CONNECT position and contacts are OPEN.

STEP 3: Ensure position indicator flag on the front of the TemRack *iR* is in the CONNECT position.

STEP 4: CLOSE the contacts of the ACB by either energizing the LRC, pressing the *ACB Control – Close* pushbutton on the LCS, or manually pressing the ON button on the front of the ACB body.

STEP 5: Ensure *ACB Control – Close* indicator is illuminated to indicate contacts are closed.

Commissioning

Base functionality testing

Rack to ISOLATE

Test that the TemRack *iR* is capable of remote racking towards the ISOLATE position from CONNECT, all status indicators operate correctly, and that the ACB contacts can be opened.

STEP 1: OPEN the contacts of the ACB by either energizing the SHT, pressing the *ACB Control – Open* pushbutton on the LCS, or manually pressing the OFF button on the front of the ACB body.

STEP 2: Ensure *ACB Control – Open* indicator is illuminated to indicate contacts are closed.

STEP 3: Issue a command to rack to the ISOLATE position. (Refer Remote racking to ISOLATE section).

STEP 4: When racking is completed, ensure LCS LED status indicators show ACB in ISOLATE position and contacts are OPEN.

STEP 5: Ensure position indicator flag on the front of the TemRack *iR* is in the ISOLATE position.

Endurance testing

Confirm that the TemRack *iR* completes multiple consecutive operations successfully. The following steps must be repeated three (3) times.

STEP 1: Issue a command to rack to the CONNECT position. (Refer Remote racking to CONNECT section).

STEP 2: When racking is completed, CLOSE the contacts of the ACB by either energizing the LRC, pressing the *ACB Control – Close* pushbutton on the LCS, or manually pressing the ON button on the front of the ACB body.

STEP 3: OPEN the contacts of the ACB by either energizing the SHT, pressing the *ACB Control – Open* pushbutton on the LCS, or manually pressing the OFF button on the front of the ACB body.

STEP 4: Issue a command to rack to the ISOLATE position. (Refer Remote racking to ISOLATE section).

STEP 5: When racking is complete, repeat from STEP 1.

Interlock testing

Confirm that the mechanical interlocking of the TemRack *iR* are functional and prevent remote racking whilst the ACB contacts are CLOSED.

WARNING: If the interlock test fails, do not proceed with commissioning of the ACB fitted with the TemRack *iR*. Remove the ACB body from service immediately and do not use. Contact NHP Service to investigate the interlock failure.

STEP 1: Issue a command to rack to the TEST position. (Refer Remote racking to TEST section).

STEP 2: When racking is completed, CLOSE the contacts of the ACB by either energizing the LRC, pressing the *ACB Control – Close* pushbutton on the LCS, or manually pressing the ON button on the front of the ACB body.

STEP 3: Issue a command to rack to the CONNECT position. (Refer Remote racking to CONNECT section).

STEP 4: Listen for sound of shutter motor attempting to open the shutter and failing. The main motor should not energise and the TemRack *iR* will not perform a racking operation.

STEP 5: Observe LCS Fault LED flashing with Fault Code 3, indicating a “shutter motor jam/overload” fault. (Refer Fault Indicator section).

STEP 6: Reset the TemRack *iR* by turning the *Enable* selector switch to the OFF position and back ON

Commissioning

Cycle counter

As of firmware version F4.8.0 the TemRack *iR* feature a cycle counter which records the number of times the TemRack *iR* enters the CONNECT position during an automated racking operation, by incrementing an internal counter by one.

Notice: The cycle counter does not increment for manual racking operation.

Notice: In the event of a fault during an automated racking operation, the cycle counter will increment by one, only if the fault occurs after entering the CONNECT position region.

A new and unused TemRack *iR* may come with the cycle counter as non-zero. This is a result of the functional testing of the TemRack *iR* components during manufacturing which intentionally increments the counter. As the cycle counter is non-resettable, these functional tests will remain in the counter from the factory.

In addition to this, the commissioning process will increment the counter several times, therefore before putting the ACB body with the TemRack *iR* into service, it is important to record the existing cycle counter for future reference.

The following procedure is used to access the TemRack *iR*'s internal cycle counter. The LED indicators on the LCS will flash to indicate the digits of the cycle count as outlined below. There will be a pause in the flash sequence, at which point it will repeat. This will continue until the *Enable* switch is turned OFF.

STEP 1: Turn the *Enable* switch to the OFF position (Refer Enabling the TemRack *iR* section).

STEP 2: Hold down the *iRRD Control/Status – Test* button.

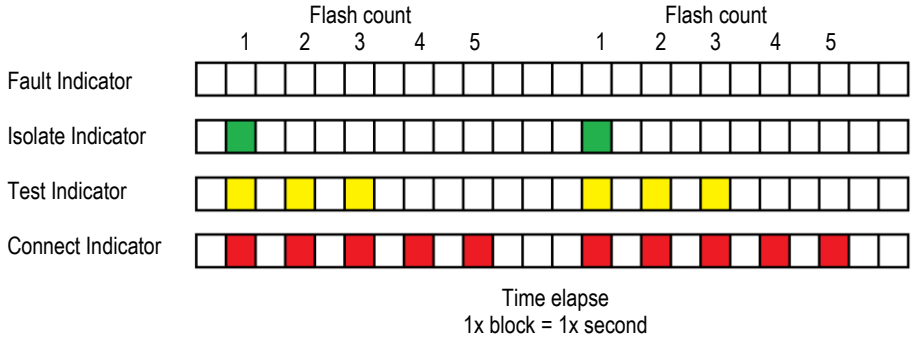
STEP 3: With the *Test* button held down, turn the *Enable* switch to the ON position.

STEP 4: Release the *Test* button.

STEP 5: Observe the *iRRD Control/Status* and *Fault* LEDs and count the number of flashes for each LED:

LED indicator	Digit representation
Fault	x1000 (thousands)
iRRD Control/Status – Isolate	x100 (hundreds
iRRD Control/Status – Test	x10 (tens)
iRRD Control/Status – Connect	x1 (ones)

Example – A cycle count of **135**. The respective LED indicators flashes once every 2 seconds at a 50% duty cycle, with a 2 second pause between flashing sequences:



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Operation

WARNING: The TemRack *iR* should be operated with clear view of the ACB and surrounding area, ensuring no personnel are nearby during operation.

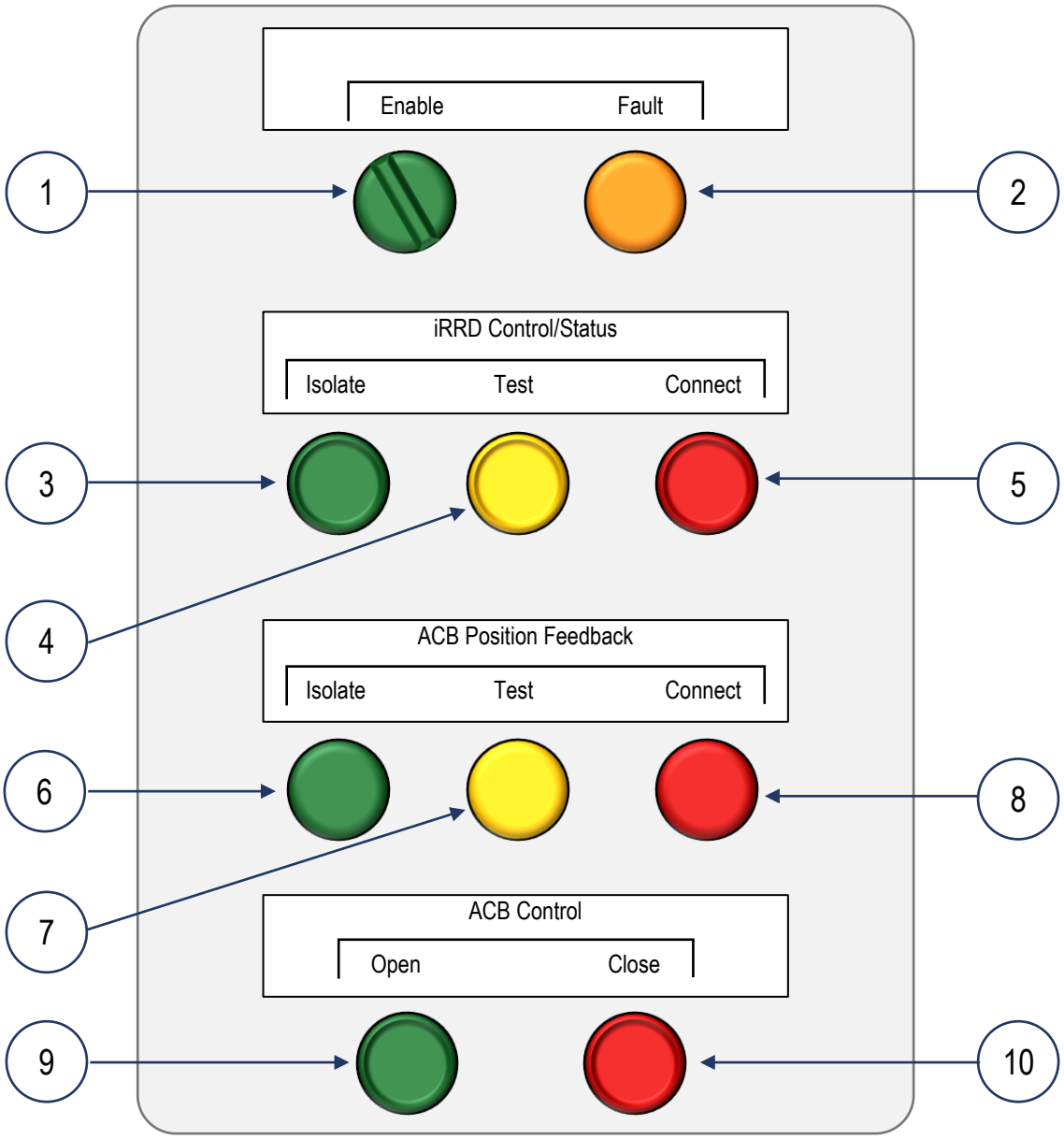
Only authorised personnel shall be permitted in the vicinity of the ACB during operation of the TemRack *iR* and must do so under strict safety procedures, which may include (but not limited to) maintaining an adequate safe distance and appropriate protective clothing.

Risk of serious damage to equipment and personal injury or death due to arc flash hazard.

Local Control Station (LCS)

The TemRack *iR* features integrated digital I/O for control and feedback, allowing the operator to remotely open or close a Terasaki ACBs and rack units in or out whilst being outside the switch room. Remote control may be performed via a local control station (LCS), or other remote methods utilising the integrated I/O.

This section describes operation using the standard LCS interface.



Operation

Local Control Station (LCS) Interface

#	Description	#	Description
1	***ENABLE* selector switch – LED illuminated, maintained operation** - Switch to enable the TemRack *iR*, providing ENABLE signal. - Illuminated solid when ENABLE signal is active. - The enable switch must remain in the enable position whilst the racking system is in use (i.e., not a momentary switch).	6	***ISOLATE* ACB feedback indicator – LED illuminated** - Illuminated solid when the ACB is in the ISOLATE position.
2	***FAULT* status indicator – LED illuminated** - Flashes when a fault has occurred with the TemRack *iR*. Refer to Fault Indicator section for diagnostics.	7	***TEST* ACB feedback indicator – LED illuminated** - Illuminated solid when the ACB is in the TEST position.
3	***ISOLATE* control pushbutton – LED illuminated, momentary operation** - Illuminated solid when the TemRack *iR* registers it is in the ISOLATE position. - If not illuminated, press to issue a command to rack to the ISOLATE position. - Flashes whilst racking in progress to ISOLATE position. - If illuminated solid, press and hold to unthread the ACB from racking screw to allow complete removal of the ACB from the carriage.	8	***CONNECT* ACB feedback indicator – LED illuminated** - Illuminated solid when the ACB is in the CONNECT position.
4	***TEST* control pushbutton – LED illuminated, momentary operation** - Illuminated solid when the TemRack *iR* registers it is in the TEST position. - If not illuminated, press to issue a command to rack to the TEST position (from ISOLATE only) - Flashes whilst racking in progress to ISOLATE position.	9	***OPEN* ACB control pushbutton – LED illuminated, momentary operation** - Press to energise ACB SHT device and OPEN the ACB contacts. - Illuminated solid when the ACB contacts are OPEN.
5	***CONNECT* control pushbutton – LED illuminated, momentary operation** - Illuminated solid when the TemRack *iR* registers it is in the CONNECT position. - If not illuminated, press to issue a command to rack to the CONNECT position - Flashes whilst racking in progress to ISOLATE position.	10	***CLOSE* ACB control pushbutton – LED illuminated, momentary operation** - Press to energise ACB LRC and CLOSE the ACB contacts. - Illuminated solid when the ACB contacts are CLOSED.

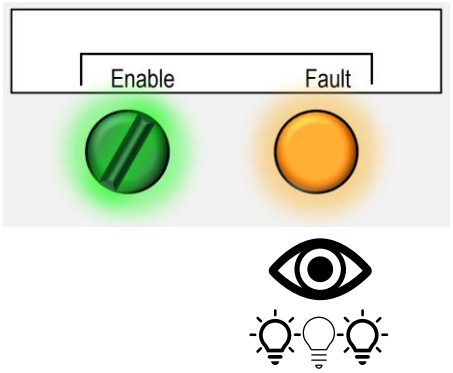
Operation

Fault Indicator

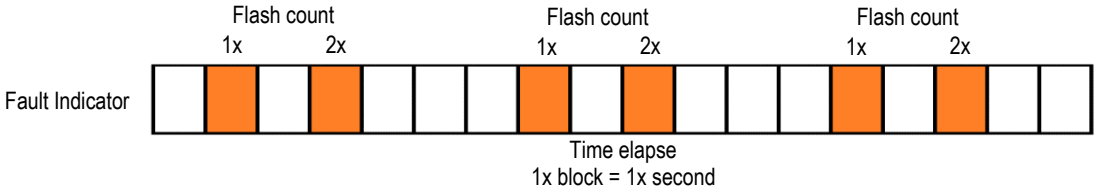
In the event of a fault, the *Fault* indicator will illuminate and flash several times followed by a pause in the sequence. The number of flashes corresponds to the fault code and is used to diagnose the nature of the fault and assist in troubleshooting.

Per the below example, 2 x flashes followed by a pause corresponds with Fault Code 2. Furthermore, 3 flashes followed by a pause corresponds with fault code 3 and so on.

Refer to the Troubleshooting section for detail on the respective fault code, possible causes and remedial advice.



Example – The *Fault* indicator flashes once every 2 seconds at a 50% duty cycle, with a 2 second pause between flashing sequences, corresponding with Fault code '2' – with 2x flashes per sequence:



The *Fault* indicator will continue to flash the fault code and prevent any further commands to be issued to the TemRack *iR*.
To reset the fault, either cycle the *Enable* switch OFF and ON, or cycle the power supply to the TemRack *iR*.

Operation

Inserting ACB body to carriage

WARNING: Manual racking must only be performed by authorised personnel under strict safety procedures. Risk of severe personal injury and/or equipment damage due to arc flash hazards and exposed moving parts.

WARNING: Ensure that the TemRack *iR* is disabled by removing the *Enable* signal, and/or isolating power supply to the TemRack *iR* before inserting the manual racking handle to avoid risk of unexpected startup.

WARNING: Manual racking should only be performed as part of the ACB body insertion and commissioning processes and/or for emergency use. Risk of damage to the TemRack *iR* and associated mechanical components. Special care must be taken whilst turning the manual racking handle to maintain a constant rotation speed. Do not use sudden and jerky movements when operating the manual racking handle.

Refer to the NHP/Terasaki TemPower 2 AR ACB Installation Manual for detailed instructions for insertion of the ACB body into the carriage via the draw-out rails.

STEP 1: With the ACB body pushed in as far as possible into the carriage, use the manual racking handle and turn two full rotations to engage the threads of the main racking screw with the threaded socket on the carriage.

STEP 2: Plug in the Anderson connector and D-sub 37-pin connector cables supplied with the TemRack *iR* into the respective receptacles on the ACB body bracket.

Operation

Removing ACB body from carriage

Removal of the ACB body from the carriage may be necessary to perform regular servicing and maintenance to the ACB assembly.

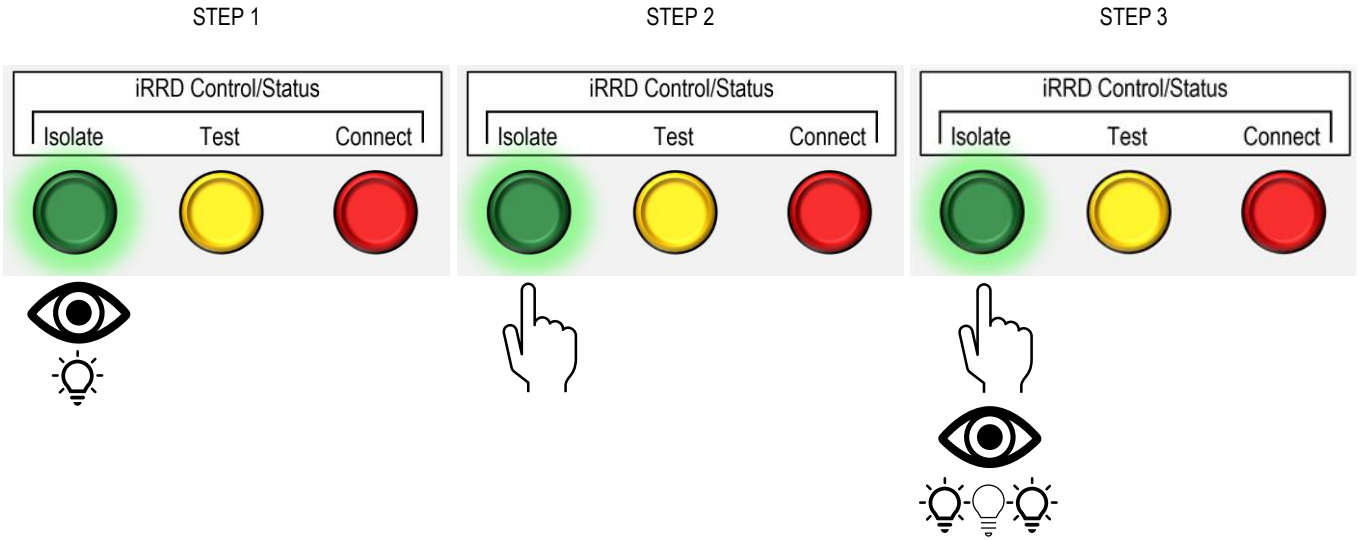
To ensure that remote racking can be reliably performed from any position, the TemRack *iR* maintains engagement of the racking screw threads, which prevents removal of the ACB body from the carriage. Therefore, the following procedure must be performed to allow removal of the ACB body.

Ensure the TemRack *iR* is enabled, and the ACB is in the ISOLATE position. Refer to Enabling the TemRack *iR* and Remote racking to ISOLATE sections

STEP 1: Observe the *iRRD Control/Status – Isolate* pushbutton indicator is illuminated, indicating that the ACB is in the ISOLATE position.

STEP 2: Press and hold the *iRRD Control/Status – Isolate* pushbutton for 5 seconds

STEP 3: While holding, observe the *iRRD Control/Status – Isolate* pushbutton indicator flashing quickly.



The TemRack *iR* will rack in reverse for a short time to remove the ACB body off the main racking screw. At which point the ACB body may now be removed from the carriage.

> **Notice**: Due to manufacturing variability, it is possible in some instances where the ACB body does not completely unthread from the main racking screw after holding the *Isolate* pushbutton once. In this case, repeat the above steps as many times as required to completely unthread from the main racking screw. This may involve pressing and holding the *Isolate* pushbutton more than once.

Refer to the NHP/Terasaki TemPower 2 AR ACB Installation Manual for detailed instructions for removal of the ACB body from the carriage.

> **Notice**: For complete removal of the ACB body off the carriage draw-out rails, ensure that the Anderson connector and D-sub 37-pin connector cables are removed from the ACB body bracket.

Operation

Remote racking procedure

WARNING: Ensure that the manual racking handle is not inserted into the ACB before attempting any remote racking operation. Risk of personal injury due to exposed moving parts, damage to the TemRack *iR* and associated ACB, and/or incorrect function of TemRack *iR* racking operation.

Notice: Observe the maximum duty cycle of the TemRack *iR* is not exceeded. Ensure sufficient cooldown between racking operations. Refer to Technical Data section for details on maximum duty.

Enabling the TemRack *iR*

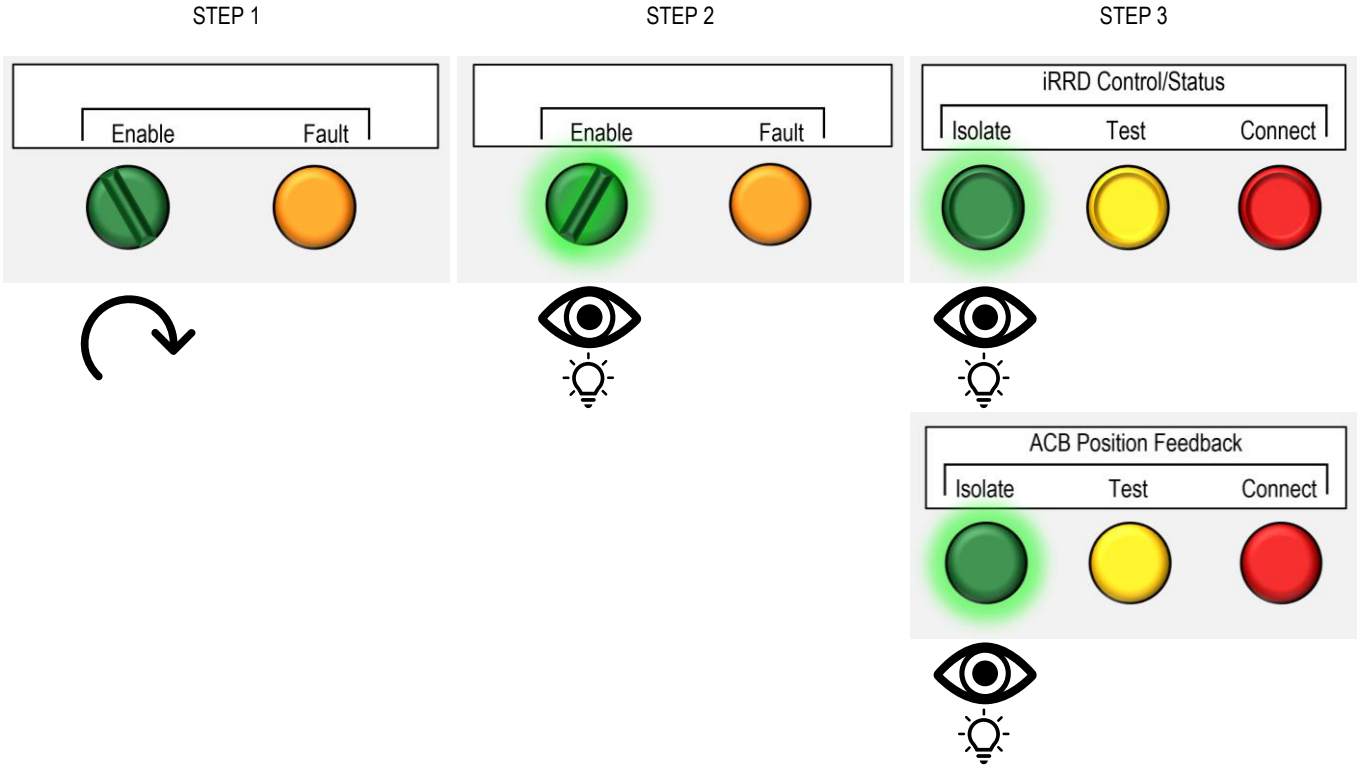
To enable operation of the TemRack *iR* the *Enable* signal must be active. Using the standard LCS, this is performed via the *Enable* selector switch.

STEP 1: Turn the *Enable* selector switch to the ON position.

STEP 2: Observe the selector switch is illuminated to confirm the Enable signal is active.

The TemRack *iR* will commence a self-diagnostic by illuminating the *Fault* indicator, and each of the *iRRD Control/Status* (*Isolate*, *Test* and *Connect*) LED indicators. When self-diagnostic is completed (and the ACB is in a known position), one of the *iRRD Control/Status* indicators will remain illuminated to indicate the current position of the ACB.

STEP 3: Observe the *iRRD Control/Status* illuminated pushbuttons and *ACB Position Feedback* indicators to determine the current position of the ACB, and that the TemRack *iR* is ready for operation. (Example shown, ACB is in ISOLATE position)



Operation

Remote racking procedure

Remote racking to TEST

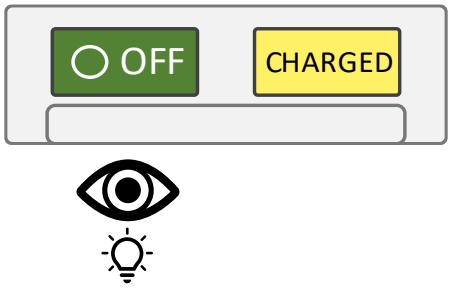
> **Notice**: Automatic remote racking to the TEST position can only be performed from the ISOLATE position. If the ACB is in the CONNECT or an unknown position, the ACB must be racked to the ISOLATE position first before proceeding.

Ensure the ACB is in the ISOLATE position, and that the ACB contacts are OPEN before attempting the racking operation.

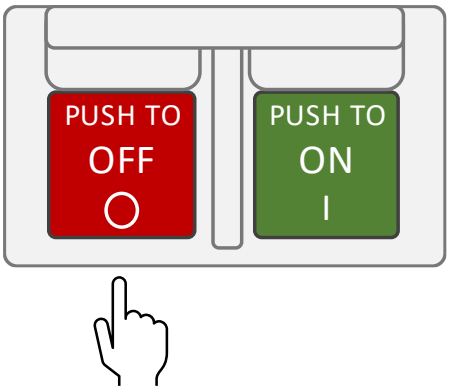
STEP 1: Ensure the ACB is in the ISOLATE position, and that the ACB contacts are OPEN before attempting the racking operation.
a. Observe the contact status on the front of the ACB, indicating that the ACB contacts are OPEN or *OFF*
b. If the ACB contacts are not open, press and release the *PUSH TO OFF* button to OPEN the contacts.

STEP 2: Observe both *iRRD Control/Status – Isolate* pushbutton and *ACB Position Feedback – Isolate* indicators are illuminated, indicating that the ACB is in the ISOLATE position.

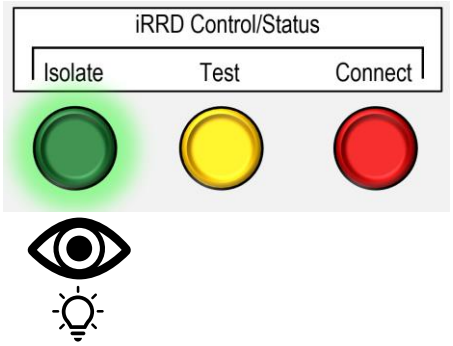
STEP 1a

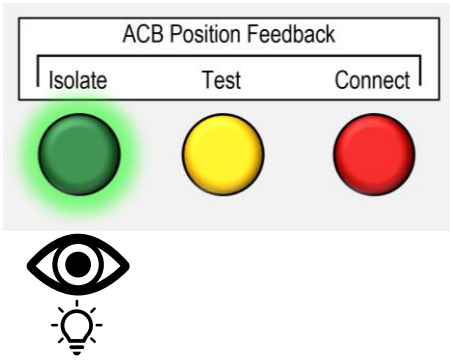


STEP 1b



STEP 2





Operation

Remote racking procedure

Remote racking to TEST

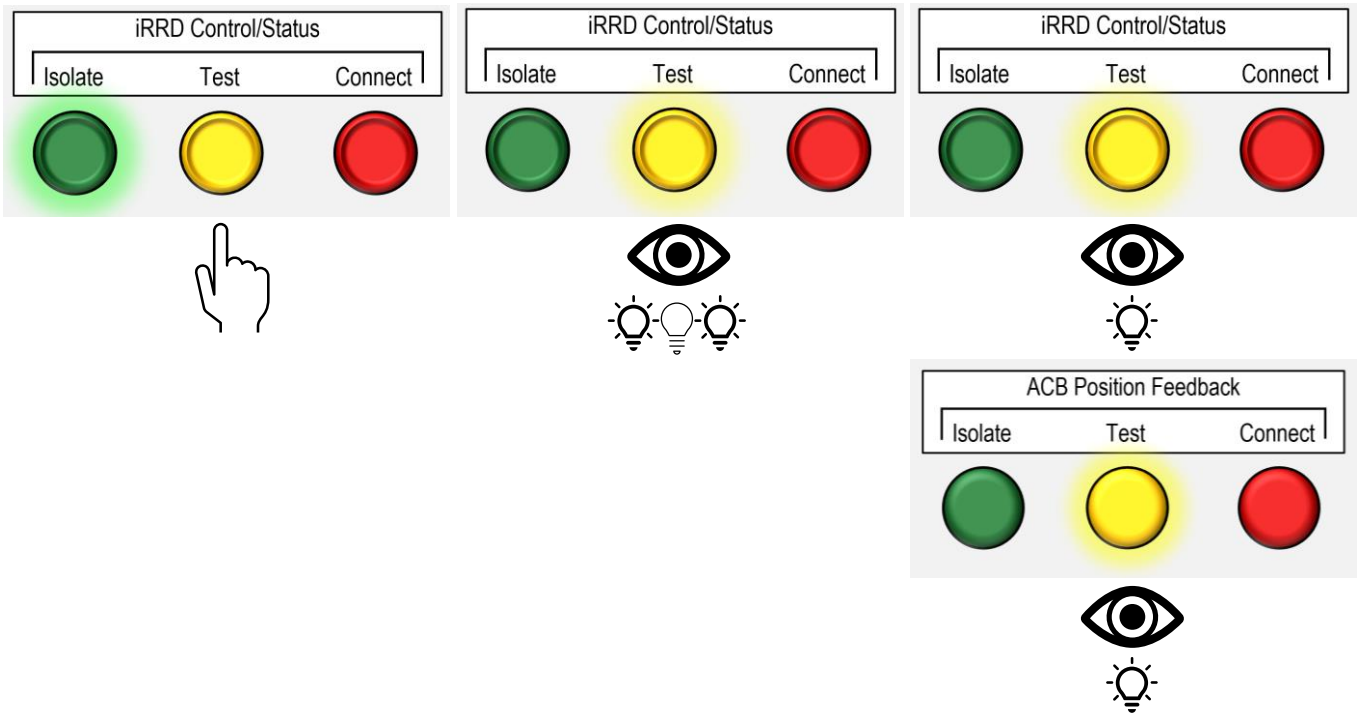
When the TemRack *iR* is ready, press and release the *iRRD Control/Status – Test* pushbutton to issue the remote racking command. Whilst the TemRack *iR* racking operation is in progress, the *iRRD Control/Status – Test* pushbutton indicator will flash ON/OFF to indicate that the racking operation is in progress. When the ACB has reached the TEST position, the *iRRD Control/Status – Test* pushbutton indicator will remain illuminated solid.

STEP 3: Press and release and release the *iRRD Control/Status – Test* pushbutton to remote rack the ACB to the TEST position.

STEP 4: Observe the *iRRD Control/Status – Test* pushbutton indicator is illuminated and flashing whilst the ACB is racking towards the TEST position

STEP 5: Observe both *iRRD Control/Status – Test* pushbutton and *ACB Position Feedback – Test* indicators are illuminated solid when the ACB has reached the TEST position and the racking operation ceases.

STEP 3 STEP 4 STEP 5



Operation

Remote racking procedure

Remote racking to CONNECT

> **Notice**: Automatic remote racking to the CONNECT position can only be performed from the ISOLATE or TEST positions. If the ACB is in an unknown position, the ACB must be racked to the ISOLATE position first before proceeding.

Ensure the ACB is in the ISOLATE or TEST position, and that the ACB contacts are OPEN before attempting the racking operation.

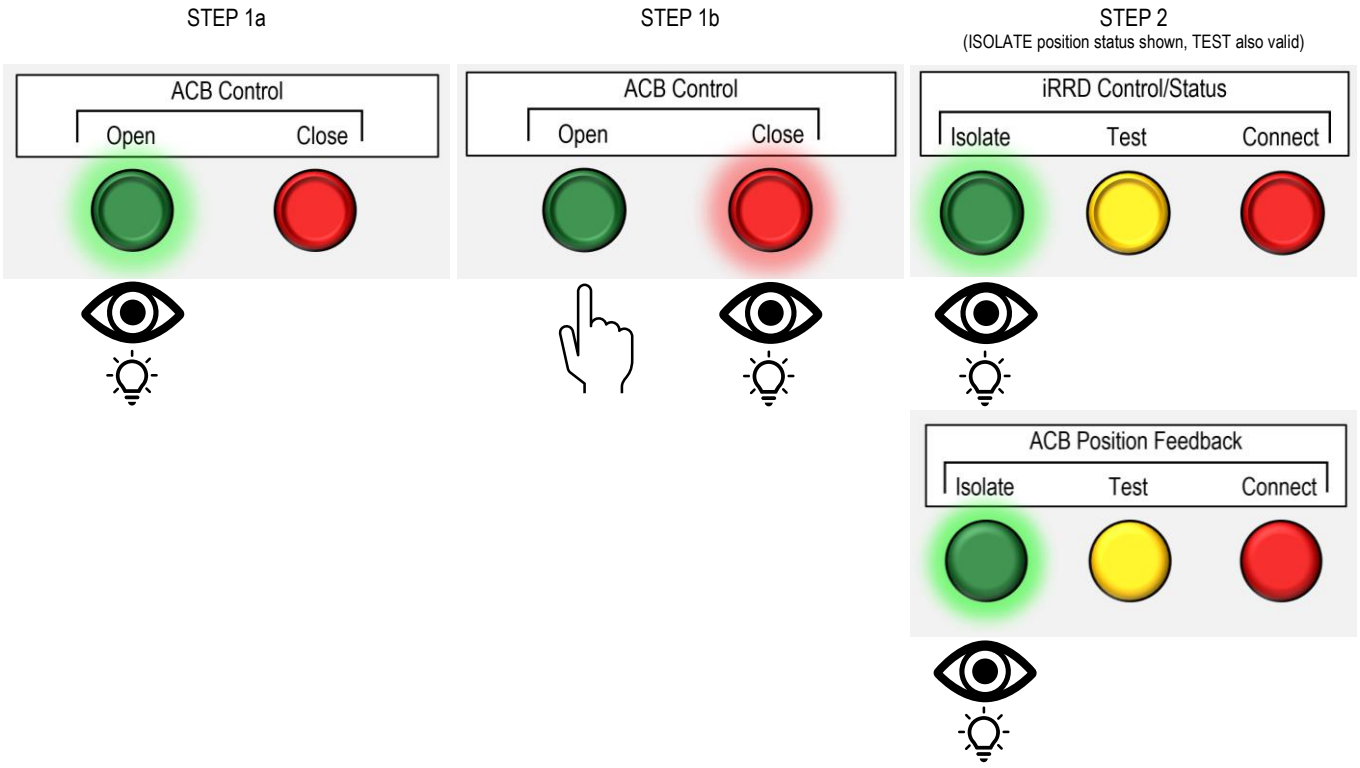
STEP 1: Ensure the ACB is in the ISOLATE position, and that the ACB contacts are OPEN before attempting the racking operation.

a. Using the standard LCS, observe the *ACB Control – Open* pushbutton indicator is illuminated, indicating that the ACB contacts are OPEN

b. If the ACB contacts are not open, press and release the *ACB Control – Open* pushbutton to energise the ACB SHT device and OPEN the contacts.

NOTE: If the ACB is in the ISOLATE position, use the indicators and buttons on the front of the ACB to ensure the contacts are in the OPEN position. Refer to STEP 1 of Remote racking to TEST

STEP 2: Observe both *iRRD Control/Status – Isolate* pushbutton and *ACB Position Feedback – Isolate* indicators are illuminated, indicating that the ACB is in the ISOLATE or TEST position.



Operation

Remote racking procedure

Remote racking to CONNECT

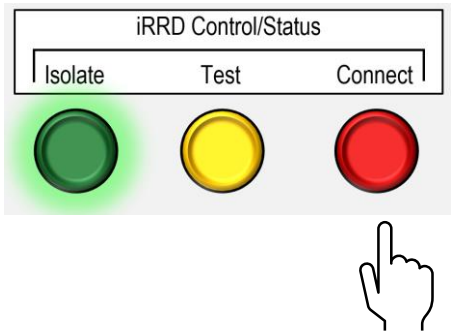
When the TemRack *iR* is ready, press and release the *iRRD Control/Status – Connect* pushbutton to issue the remote racking command. Whilst the TemRack *iR* racking operation is in progress, the *iRRD Control/Status – Connect* pushbutton indicator will flash ON/OFF to indicate that the racking operation is in progress. When the ACB has reached the CONNECT position, the *iRRD Control/Status – Connect* pushbutton indicator will remain illuminated solid.

STEP 3: Press and release the *iRRD Control/Status – Connect* pushbutton to remote rack the ACB to the CONNECT position.

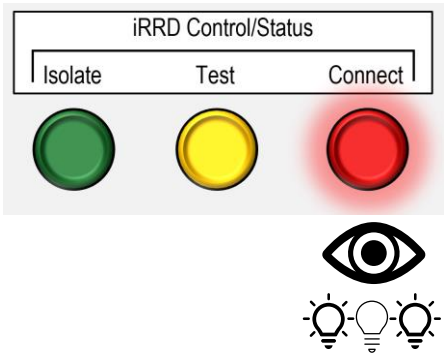
STEP 4: Observe the *iRRD Control/Status – Connect* pushbutton indicator is illuminated and flashing whilst the ACB is racking towards the CONNECT position

STEP 5: Observe both *iRRD Control/Status – Connect* pushbutton and *ACB Position Feedback – Connect* indicators are illuminated solid when the ACB has reached the CONNECT position and the racking operation ceases.

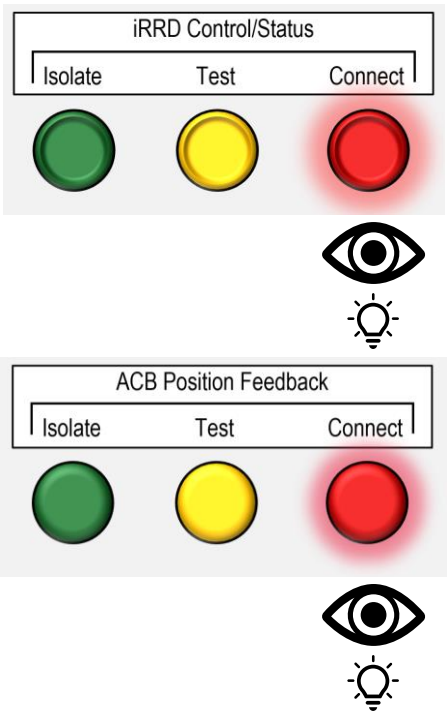
STEP 3
(ISOLATE position status shown, TEST also valid)



STEP 4



STEP 5



Operation

Remote racking procedure

Remote racking to ISOLATE

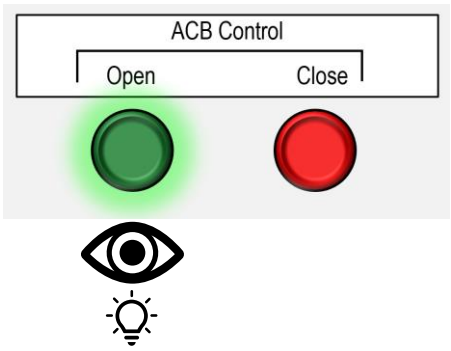
Remote racking to ISOLATE can be performed from any ACB position, including unknown position; however as with all other racking operations, remote racking must only be performed when the ACB contacts are OPEN

STEP 1: Ensure that the ACB contacts are OPEN before attempting the racking operation.

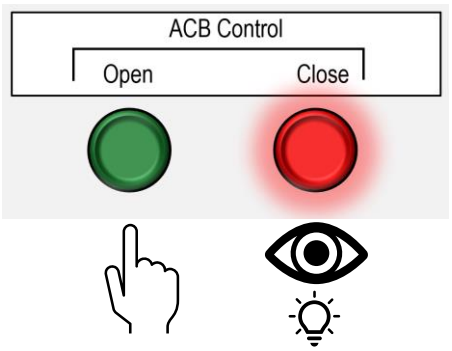
a. Using the standard LCS, observe the *ACB Control – Open* pushbutton indicator is illuminated, indicating that the ACB contacts are OPEN

b. If the ACB contacts are not open, press and release the *ACB Control – Open* pushbutton to energise the ACB SHT device and OPEN the contacts.

STEP 1a



STEP 1b



Operation

Remote racking procedure

Remote racking to ISOLATE

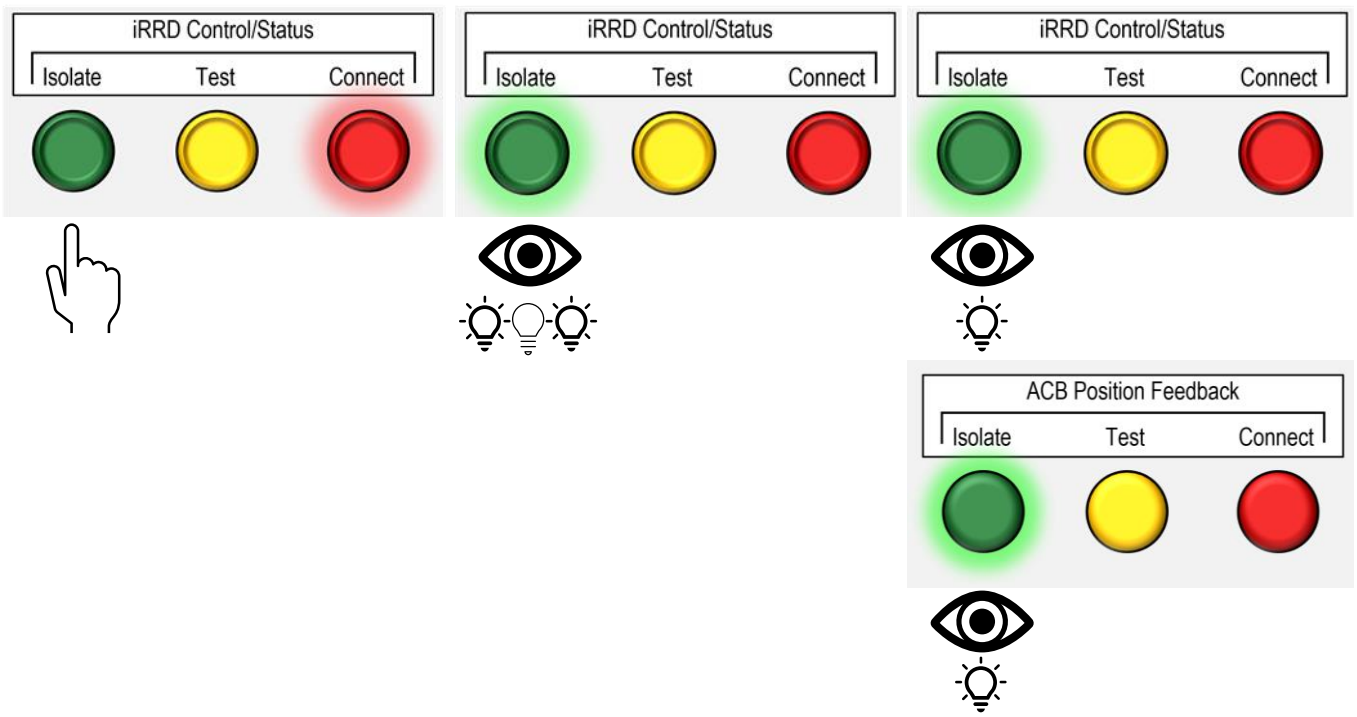
When the TemRack *iR* is ready, press and release the *iRRD Control/Status – Isolate* pushbutton to issue the remote racking command. Whilst the TemRack *iR* racking operation is in progress, the *iRRD Control/Status – Isolate* pushbutton indicator will flash ON/OFF to indicate that the racking operation is in progress. When the ACB has reached the ISOLATE position, the *iRRD Control/Status – Isolate* pushbutton indicator will remain illuminated solid.

STEP 2: Press and release the *iRRD Control/Status – Isolate* pushbutton to remote rack the ACB to the ISOLATE position.

STEP 3: Observe the *iRRD Control/Status – Isolate* pushbutton indicator is illuminated and flashing whilst the ACB is racking towards the ISOLATE position

STEP 4: Observe both *iRRD Control/Status – Isolate* pushbutton and *ACB Position Feedback – Isolate* indicators are illuminated solid when the ACB has reached the ISOLATE position and the racking operation ceases.

STEP 2 STEP 3 STEP 4



Operation

Manual racking

WARNING: Manual racking must only be performed by authorised personnel under strict safety procedures. Risk of severe personal injury and/or equipment damage due to arc flash hazards and exposed moving parts.

WARNING: Ensure that the TemRack *iR* is disabled by removing the *Enable* signal, and/or isolating power supply to the TemRack *iR* before inserting the manual racking handle to avoid risk of unexpected startup.

WARNING: Manual racking should only be performed as part of the ACB body insertion and commissioning processes and/or for emergency use. Risk of damage to the TemRack *iR* and associated mechanical components. Special care must be taken whilst turning the manual racking handle to maintain a constant rotation speed. Do not use sudden and jerky movements when operating the manual racking handle.

In case of fault or unexpected behaviour, the TemRack *iR* permits local manual racking with the insertion of the manual racking handle.

Refer to the NHP/Terasaki TemPower 2 AR ACB Installation Manual for detailed instructions for manual racking.

For supplementary guidance for manual racking, refer to Commissioning – ACB body and carriage alignment testing section.

Maintenance

Overview of maintenance

WARNING: The TemRack *iR* must only be installed and commissioned by NHP Service personnel, or other personnel authorised to carry out the work by NHP. This includes either on-site or factory-fit installation of the TemRack *iR* assembly.

Notice: Do not perform dielectric withstand/insulation resistance tests on the TemRack *iR* directly, or any associated wiring whilst the TemRack *iR* is connected. Ensure that all control and power wiring is disconnected beforehand to avoid damage to the TemRack *iR*.

The service life of the TemRack *iR* and associated ACB depends on the working and environmental conditions. The TemRack *iR* is exposed to mechanical and electrical stresses and thus suffers gradual degradation during use, which will increase the possibility of malfunctions. Preventive maintenance and periodical inspection are very important to avoid any functional degradation, prevent malfunctions, extend the service life, and ensure safe operation.

Service and maintenance of the ACB requires removal of the ACB body from the carriage. Refer to Removing ACB body from carriage section.

i. All maintenance should be carried out by qualified NHP Service technicians.
ii. Unit should be serviced after 100 operations or at a yearly interval (whichever comes first).
iii. It is recommended to operate the TemRack *iR* at least once a year

Both automated and manual racking systems rely on mechanical processes, requiring well maintained moving parts. As part of regular servicing of the ACB, ensure that all moving parts and points of contact are adequately lubricated. This also include the use of contact grease on the ACB body contact clusters.

Refer to Maintenance section and NHP/Terasaki TemPower 2 AR ACB Installation Manual for further detail.

Troubleshooting

In the event of a fault or problem when using the TemRack *iR*, this section provides advice and suggested steps for resolving and identifying issues.

Some faults may require service or repair to the TemRack *iR* or ACB body/carriage assembly, which must only be performed by an NHP Service technician or authorised personnel. Contact the NHP Service team so that a service inspection can be arranged. Call AU 0393 684 044 or NZ 0800 647 647 for servicing enquiries.

WARNING: If, during troubleshooting, there is a requirement to enter the switch room for inspection of the ACB assembly or manual racking, personnel must ensure that required safety practices and procedures are followed.

	Problem	Possible cause	Remedial advice
1.	The TemRack *iR* does not turn on.	Insufficient or no power to the TemRack *iR*	Verify external 24V dc power supply is operational at correct voltage. Refer to Installation – Power Supply section.
		Incorrect or faulty wiring	Verify integrity of wiring and connections. Check for and correct any: - Loose connections to ACB carriage and body wiring looms and terminals - Loose connection to TemRack *iR* internal wiring loom to PCB - Incorrect terminals / conductors / connector pins Verify iR Enable input signal: - iR Enable selector switch on LCS is ON and illuminated. - Signal to iR Enable input terminal on DC-37 breakout board is at 24V dc. - Input signal voltage source shares a common negative with TemRack *iR* power supply. Refer to Installation – Wiring section
		TemRack *iR* PCB or internal wiring loom is faulty	Contact NHP Service to service or replace TemRack *iR* assembly
2.	No position status or fault indicator lights	Insufficient or no power to the TemRack *iR*	Verify external 24V dc power supply is operational at correct voltage. Refer to Installation – Power Supply section.
		Incorrect or faulty wiring	Verify integrity of wiring and connections. Check for and correct any: - Loose connections to ACB carriage and body wiring looms and terminals - Loose connection to TemRack *iR* internal wiring loom to PCB - Incorrect terminals / conductors / connector pins - Incorrect power supply polarity Verify iR Enable input signal: - iR Enable selector switch on LCS is ON and illuminated. - Signal to iR Enable input terminal on DC-37 breakout board is at 24V dc. - Input signal voltage source shares a common negative with TemRack *iR* power supply. Refer to Installation – Wiring section
		The ACB is in an unknown position	May occur where the previous racking operation failed or did not complete successfully. Press and release the *Isolate* button to rack the ACB to the ISOLATE position; and repeat the original racking command to move the ACB to the desired position.
		TemRack *iR* PCB assembly or internal wiring loom faulty	Contact NHP Service to service or replace TemRack *iR* assembly

Troubleshooting

	Problem	Possible cause	Remedial advice
3	Fault indicator is flashing	The TemRack *iR* has experienced a fault during operation. Refer to Operation – Fault Indicator section, and the respective fault code below.	Observe the number of flashes to determine the corresponding fault code. Refer to the below listed problem for the respective fault code.
	Fault Code 1: Main motor jam/overload	Occurs during racking operation where the racking screw (as driven by the main motor) is unable to move or has restricted movement. Foreign object or other obstruction	If racking towards CONNECT, observe at which point the overload/jam has occurred. Reset the TemRack *iR* by cycling the Enable signal. Press and release the *Isolate* button to rack the ACB to the ISOLATE position; and repeat the original racking command to move the ACB to the desired position. If the ACB does not move and repeats the same fault code it may indicate a jam has occurred, either due to foreign objects or other obstructions. In this scenario manually racking the breaker to ISOLATED position is required. The user should follow company/site specific procedures to manually remove the breaker, which may also involve isolation of the switchboard and/or other required safety precautions. Inspect carriage and ensure any foreign objects or obstructions are cleared before re-installing the ACB.
		Insufficient power supply	When the ACB contact clusters begin to engage the carriage busbar, the current draw is at its peak. Insufficient power supply may produce low motor torque. This may also be caused by improper wiring practices or high-resistance joints. Refer to Installation – Power Supply section for correct power supply and conductor sizing.
		Inadequate lubrication	Both automated and manual racking systems rely on mechanical processes, requiring well maintained moving parts. Ensure that all moving parts and points of contact are adequately lubricated. This also include the use of contact grease on the ACB body contact clusters. Refer to Maintenance section and NHP/Terasaki TemPower 2 AR ACB Installation Manual for further detail. Some maintenance must only be performed by NHP Service technicians or authorised personnel. Contact NHP Service for assistance.
		Test-release button jammed or faulty	The test-release button is used during manual racking procedure to indicate to the user when the limits of the TEST position have been reached by jamming the main drive shaft. The user is required to press the test-release button to continue racking out of the TEST position, to either ISOLATE or CONNECT positions. In the case of the TemRack *iR*, the test-release button is pulled in automatically. If a jam occurs it may have been caused by the test-release button having not been pulled in sufficiently. Observe the test-release button to ensure it pulls in before entering the TEST position in either racking direction. If not, there may be a problem with the internal test-release servo preventing full actuation. Manually press the test-release button on the front of the ACB. If it cannot be pressed easily, insert the manual racking handle and rotate slightly in either direction to release tension on the main drive shaft, then attempt to press the release button again.
		Overheating	Excessive number of racking operations, exceeding the recommended duty cycle of the TemRack *iR*. Refer to the Product Information – Technical Data section for maximum duty. Allow the TemRack *iR* to cool down before attempting another automated racking operation.
		PCB, internal wiring loom or other electronic or mechanical components faulty.	Contact NHP Service to service or replace TemRack *iR* assembly.

Troubleshooting

	Problem	Possible cause	Remedial advice
	Fault Code 2: Main motor timeout	Racking screw is not fully inserted into threaded socket on carriage	If previously removed (or before the initial racking operation after being inserted to the carriage) the ACB body needs to have been inserted correctly into the carriage before attempting the automated racking procedure. This ensures that there is at least one thread of the racking screw engaged with the threaded socket on the carriage. Refer to Inserting ACB body to carriage section.
		Carriage mechanical fault	The threaded socket and contact insertion assembly on the ACB carriage may be faulty or damaged, preventing the ACB body from moving into the required position. Remove the ACB body from the carriage and inspect the mechanisms in the carriage for damage, misalignment or other failure. Some maintenance must only be performed by NHP Service technicians or authorised personnel. Contact NHP Service for assistance.
		PCB, internal wiring loom or other electronic or mechanical components faulty.	Contact NHP Service to service or replace TemRack *iR* assembly.
	Fault Code 3: Shutter motor jam/overload	ACB is in closed/ON state	As a safety precaution, the ACB cannot be racked into any other positions whilst the contacts are in the closed/ON position. Safety interlocks internal to the ACB prevent movement of the safety shutter (which would otherwise be pushed by inserting the manual racking handle). Open the ACB contacts by pressing the manual OFF button on the front of the ACB, or remotely by energizing the SHT device if installed.
		Padlock attachment is in use or stuck	If all padlocks and hasps have been removed, ensure the padlock attachment is free to return into the ACB body under its own spring return mechanism. Inspect for any foreign objects or obstruction preventing the return of the padlock attachment. Attempt to manually push the padlock attachment back into the ACB body.
		Insufficient power supply	Insufficient voltage or undersized power supply to drive the shutter motor correctly. Verify external 24V dc power supply is operational at correct voltage. Refer to Installation – Power Supply section.
		Overvoltage on power supply	Exceeding the rated voltage of the TemRack *iR* may present as an overload on the shutter motor. Verify external 24V dc power supply is operational at correct voltage. Refer to Installation – Power Supply section.
		Foreign object or other obstruction	Inspect and clear any foreign objects or obstructions that may be visible in the manual racking handle socket.
		PCB, internal wiring loom or other electronic or mechanical components faulty.	Contact NHP Service to service or replace TemRack *iR* assembly.

Troubleshooting

	Problem	Possible cause	Remedial advice
	Fault Code 4: Shutter motor timeout	PCB, internal wiring loom or other electronic or mechanical components faulty.	Contact NHP Service to service or replace TemRack *iR* assembly.
	Fault Code 5: Shutter not in homed/closed position	PCB, internal wiring loom or other electronic or mechanical components faulty.	Contact NHP Service to service or replace TemRack *iR* assembly.
	Fault Code 6: Shutter not in opened position	PCB, internal wiring loom or other electronic or mechanical components faulty.	Contact NHP Service to service or replace TemRack *iR* assembly.
4	ACB does not rack fully into commanded position	Carriage mechanical fault	The TemRack *iR* relies on mechanical feedback from the carriage protrusion (or 'tombstone) on the bottom of the ACB carriage, to determine the physical position of the ACB body. Where this protrusion becomes misaligned, bent, or otherwise damaged, the TemRack *iR* cannot reliably determine its position and thus rack to the correct position. Remove the ACB body from the carriage and inspect the mechanisms in the carriage for damage, misalignment, or other failure. Some maintenance must only be performed by NHP Service technicians or authorised personnel. Contact NHP Service for assistance.
		PCB, internal wiring loom or other electronic or mechanical components faulty.	Contact NHP Service to service or replace TemRack *iR* assembly.
5	ACB Position Feedback indicators do not match iRRD Control/Status indicators.	Carriage mechanical fault	The TemRack *iR* relies on mechanical feedback from the carriage protrusion (or 'tombstone) on the bottom of the ACB carriage, to determine the physical position of the ACB body. Where this protrusion becomes misaligned, bent, or otherwise damaged, the TemRack *iR* cannot reliably determine its position and thus rack to the correct position. Remove the ACB body from the carriage and inspect the mechanisms in the carriage for damage, misalignment, or other failure. Some maintenance must only be performed by NHP Service technicians or authorised personnel. Contact NHP Service for assistance.
		PCB, internal wiring loom or other electronic or mechanical components faulty.	Contact NHP Service to service or replace TemRack *iR* assembly.

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