

Reflex iC60 Integrated Control Circuit Breaker

iC60 Circuit-Breakers Reference Manual

09/2015



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When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book



At a Glance

Document Scope

This manual is intended for designers and installers of control systems and electrical protection systems.

Validity Note

Reflex iC60 integrated control circuit breakers are used for remote control and protection of installations via either electrical control or PLC control.

Related Documents

Title of Documentation	Reference Number
Instruction Sheet for Reflex iC60 integrated control circuit breakers	S1B8674701

You can download these technical publications and other technical information from our website at <http://download.schneider-electric.com>

Chapter 1

Introduction

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Overview	10
Description	12

Overview

Introduction

The Reflex iC60 integrated control circuit breaker combines the function for remote control of an installation and the protection functions of a circuit breaker in a single unit. Reflex iC60 integrated control circuit breakers are available with 2, 3, and 4 poles.

All Reflex iC60 products have two 230 Vac local controls:

- Input Y1: latched order local control or on edges (depending on operating mode)
- Input Y2: local one-shot closing and opening control

The Reflex iC60 product version with Ti24 interface enables the Reflex iC60 circuit breaker to interface directly with a PLC, in order to:

- Execute remote control (input Y3, low level 24 Vdc)
- Indicate the circuit breaker state (auto/OFF contacts)
- Indicate the control circuit state (O/C contacts)

The iMDU auxiliary is used to control the Reflex iC60 circuit breaker at 24/48 Vac/dc.

Catalog numbers of Reflex iC60 circuit breakers

There are two families of integrated control circuit breakers (Reflex iC60N and Reflex iC60H) which are characterized by their breaking capacity.

Family	Reflex iC60N		Reflex iC60H	
	Operating voltage Ue	220...240 V	380...415 V	220...240 V
Ultimate breaking capacity Icu	20 kA	10 kA	30 kA	15 kA
Service breaking capacity Ics	<ul style="list-style-type: none"> • 63 A rating: 50% Icu • Other ratings: 75% Icu 		All ratings: 50% Icu	

The composition rule for A9C..... catalog numbers is as follows:

Field	A9	C	• = 5 / 6	• = 1 / 2 / 3 / 4	• = 2 / 3 / 4	•• = A
Meaning	Acti 9 range	Control	5 = without Ti24 interface 6 = with Ti24 interface	1 = type N, curve B 2 = type N, curve C 3 = type N, curve D 4 = type H, curve B	2 = 2 poles 3 = 3 poles 4 = 4 poles	•• = 10 A/16 A/25 A/40 A/63 A

Example: Catalog number A9C62316 corresponds to a type N, curve C, 3P, 16 A Reflex iC60 integrated control circuit breaker with Ti24 interface.

Catalog numbers of Reflex iC60N integrated control circuit breakers with Ti24 interface:

Reflex iC60N	Number of poles								
	2 P			3 P			4 P		
	Tripping curves								
Rating	B	C	D	B	C	D	B	C	D
10 A	A9C61210	A9C62210	A9C63210	A9C61310	A9C62310	A9C63310	A9C61410	A9C62410	A9C63410
16 A	A9C61216	A9C62216	A9C63216	A9C61316	A9C62316	A9C63316	A9C61416	A9C62416	A9C63416
25 A	A9C61225	A9C62225	A9C63225	A9C61325	A9C62325	A9C63325	A9C61425	A9C62425	A9C63425
40 A	A9C61240	A9C62240	-	A9C61340	A9C62340	-	A9C61440	A9C62440	-
63 A	A9C61263	A9C62263	-	A9C61363	A9C62363	-	A9C61463	A9C62463	-

Catalog numbers of Reflex iC60N integrated control circuit breakers without Ti24 interface:

Reflex iC60N	Number of poles								
	2 P			3 P			4 P		
	Tripping curves								
Rating	B	C	D	B	C	D	B	C	D
10 A	-	A9C52210	-	-	A9C52310	-	-	A9C52410	-
16 A	-	A9C52216	-	-	A9C52316	-	-	A9C52416	-
25 A	-	A9C52225	-	-	A9C52325	-	-	A9C52425	-
40 A	-	A9C52240	-	-	A9C52340	-	-	A9C52440	-
63 A	-	A9C52263	-	-	A9C52363	-	-	A9C52463	-

Catalog numbers of Reflex iC60H integrated control circuit breakers with Ti24 interface:

Reflex iC60H	Number of poles								
	2 P			3 P			4 P		
	Tripping curves								
Rating	B	C	D	B	C	D	B	C	D
10 A	A9C64210	A9C65210	A9C66210	A9C64310	A9C65310	A9C66310	A9C64410	A9C65410	A9C66410
16 A	A9C64216	A9C65216	A9C66216	A9C64316	A9C65316	A9C66316	A9C64416	A9C65416	A9C66416
25 A	A9C64225	A9C65225	A9C66225	A9C64325	A9C65325	A9C66325	A9C64425	A9C65425	A9C66425
40 A	A9C64240	A9C65240	A9C66240	A9C64340	A9C65340	A9C66340	A9C64440	A9C65440	A9C66440

Description of optional auxiliaries

The iMDU adapter auxiliary enables the Reflex iC60 integrated control circuit breaker to be used with a 24...48 Vac/dc control voltage.

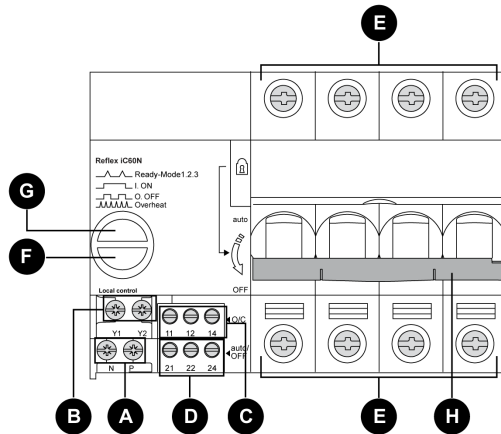
Product designation	Catalog number	Description
iMDU	A9C18195	24 or 48 Vac/dc – 230 Vac adapter module

The Vigi iC60 module is used to measure the differential residual current.

Product designation	Catalog number	Description
Vigi iC60	A9V..... and A9Q.....	Differential residual current detection module

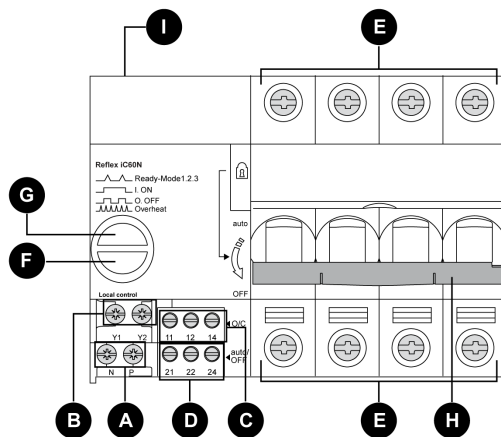
Description

Reflex iC60 integrated control circuit breaker without Ti24 interface



- A 230 Vac power supply terminal block
- B Y1/Y2 control input terminal block
- C Terminal block with control circuit state indication contacts (O/C contacts)
- D Terminal block with circuit breaker state indication contacts (auto/OFF contacts)
- E Isolated terminals
- F Circuit breaker pushbutton for manual control and selection of operating mode
- G Circuit breaker operating state LED
- H Resetting handle for circuit breaker

Reflex iC60 integrated control circuit breaker with Ti24 interface



- A 230 Vac power supply terminal block
- B Y1/Y2 control input terminal block
- C Terminal block with control circuit state indication contacts (O/C contacts)
- D Terminal block with circuit breaker state indication contacts (auto/OFF contacts)
- E Isolated terminals
- F Circuit breaker pushbutton for manual control and selection of operating mode
- G Circuit breaker operating state LED
- H Resetting handle for circuit breaker
- I Ti24 interface

Chapter 2

Sizing the Reflex iC60 Power Supply

Sizing the Reflex iC60 Power Supply

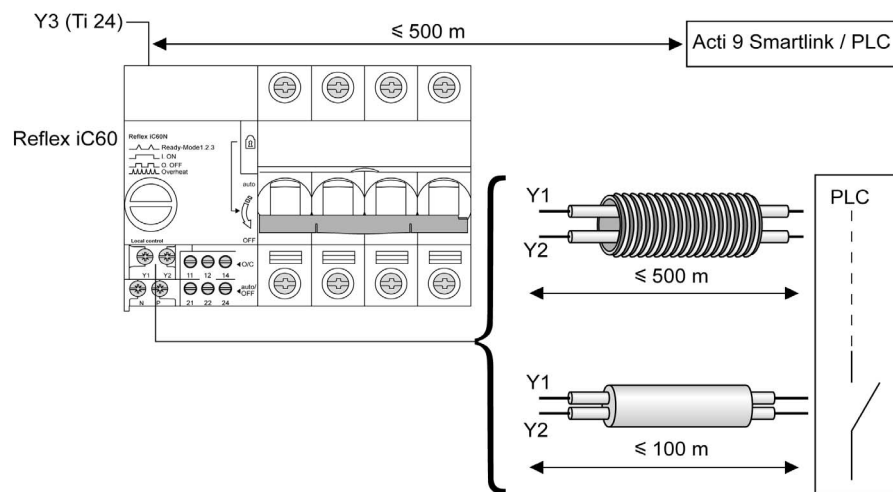
Introduction

To ensure that Reflex iC60 operates correctly, it is important to check that the power required by the control circuit power supply is adequate.

Control Circuit: Inputs Y1, Y2 and Y3

The data in the following table are used to calculate the power required by the control circuit power supply:

Characteristics		Values		
Control voltage U_c of inputs Y1 and Y2		<ul style="list-style-type: none"> 230 Vac 24...48 Vac/dc, with iMDU auxiliary 		
Control voltage U_c of input Y3		24 Vdc		
Minimum duration of control pulse for input Y2		200 ms		
Maximum response time		250 ms		
Inrush currents for 230 Vac, 50/60 Hz control ⁽¹⁾		Measured peak current	Current duration	Measured rms current
	2P	11.4 A	10 ms	7.6 A
	3P	21.8 A	10 ms	14.5 A
	4P	21.8 A	10 ms	14.5 A
Maximum apparent power in steady state Y1, Y2		5.3 VA		
Maximum apparent power in steady state Y3		0.12 VA		
Maximum length of control wires for input Y3		500 m (see diagram below)		
Maximum length of control wires for inputs Y1, Y2 (2-wire with sheath)		500 m (see diagram below)		
Maximum length of control wires for inputs Y1, Y2 (cable)		100 m (see diagram below)		
(1) The inrush currents are added together if several Reflex iC60 are being controlled simultaneously. We therefore recommend staggering controls by at least 10 ms (using the PLC or timing relays).				



Isolation Transformer

To determine the size of an isolation transformer supplying power to Reflex iC60 circuit breakers, we recommend networking:

- 3 Reflex iC60 maximum for a 500 VA transformer
- 6 Reflex iC60 maximum for a 1000 VA transformer

Chapter 3

Technical Characteristics

Technical Characteristics

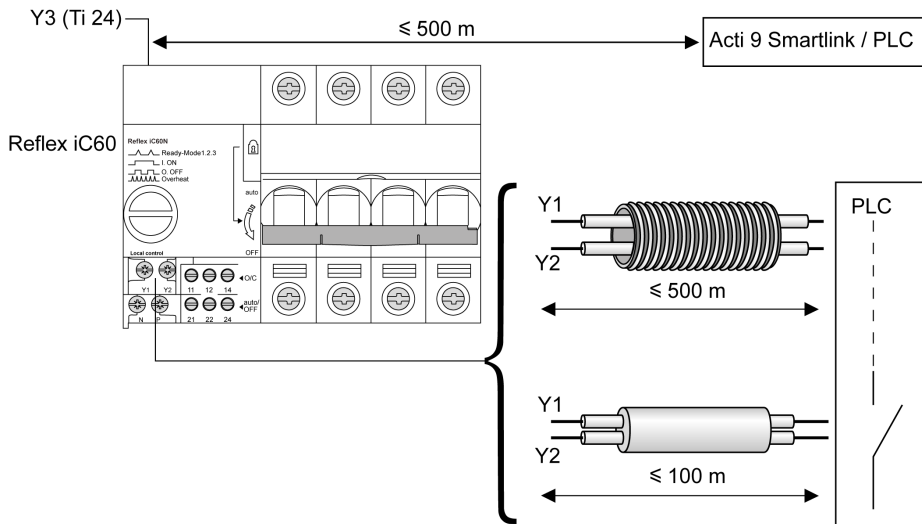
General characteristics

Characteristics		Value
Degree of protection (IEC 60529)	Device alone	IP20
	Device in a modular enclosure	IP40 (insulation class II)
Degree of protection (IEC 62262:2002)		IK05
Degree of pollution (IEC 60947)		3
Rail mounting		DIN 35 mm
Installation position		Any
Supply voltage U_e		230 Vac, 50/60 Hz
Insulation voltage U_i		500 V
Rated impulse withstand voltage U_{imp}		<ul style="list-style-type: none"> ● 4 kV in Ready position ● 6 kV in isolated position
Operating temperature		-25...+60°C
Storage temperature		-40...+85°C
Tropicalization		Execution 2 (93% relative humidity at +40°C)
Weight	2P	480 g
	3P	620 g
	4P	750 g
Electrical endurance	AC1	up to 30,000 cycles
	AC5a	up to 6,000 cycles
	AC5b	up to 6,000 cycles
Mechanical durability (C/O)		> 50,000 cycles
Resistance to voltage dips		IEC 61000-4-11 class III
Immunity to power supply frequency variation		IEC 61000-4-28 and IACS E10
Harmonic resistance		IEC 61000-4-13 class 2
Immunity to electrostatic discharge	air	8 kV, IEC 61000-4-2
	contact	4 kV, IEC 61000-4-2
Immunity to radiated magnetic fields		10 V/m up to 3 GHz, IEC 61000-4-3
Immunity to fast transients		4 kV from 5...100 kHz, IEC 61000-4-4
Surge immunity		IEC 61000-4-5
Immunity to conducted magnetic fields		10 V from 150 kHz to 80 MHz, IEC 61000-4-6
Immunity to magnetic fields at line frequency		level 4 30 A/m according to IEC 61000-4-8 and IEC 61000-4-9
Fire resistance (glow wire)	for live parts	at 960°C 30 s/30 s according to IEC 60695-2-10 and IEC 60695-2-11
	for other parts	at 650°C 30 s/30 s according to IEC 60695-2-10 and IEC 60695-2-11
	for handle	at 750°C 30 s/30 s according to IEC 60695-2-10 and IEC 60695-2-11
Conducted emissions		CISPR 11/22
Radiated emissions		CISPR 11/22
Resistance to corrosive atmospheres (4-gas test)		IEC 60721-3-3 category 3C2

Characteristics	Value
Salt mist	Severity 2 according to IEC 60068-2-52
Environment	Conforms to RoHS directives, halogen free

Control Circuit: Inputs Y1, Y2 and Y3

Characteristics	Values			
Control voltage U_c of inputs Y1 and Y2	<ul style="list-style-type: none"> 230 Vac 24...48 Vac/dc, with iMDU auxiliary 			
Control voltage U_c of input Y3	24 Vdc			
Minimum duration of control pulse for input Y2	200 ms			
Maximum response time	250 ms			
Inrush currents for 230 Vac, 50/60 Hz control ⁽¹⁾	Measured peak current	Current duration	Measured rms current	
	2P	11.4 A	10 ms	7.6 A
	3P	21.8 A	10 ms	14.5 A
	4P	21.8 A	10 ms	14.5 A
Maximum apparent power in steady state Y1, Y2	5.3 VA			
Maximum apparent power in steady state Y3	0.12 VA			
Maximum length of control wires for input Y3	500 m (see diagram below)			
Maximum length of control wires for inputs Y1, Y2 (2-wire with sheath)	500 m (see diagram below)			
Maximum length of control wires for inputs Y1, Y2 (cable)	100 m (see diagram below)			
(1) The inrush currents are added together if several Reflex iC60 are being controlled simultaneously. We therefore recommend staggering controls by at least 10 ms (using the PLC or timing relays).				



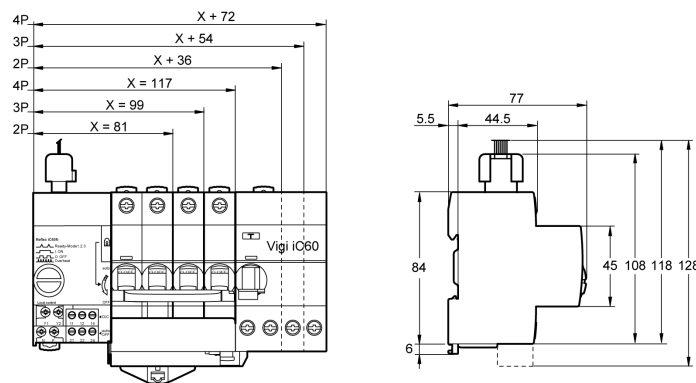
Remote Indication: O/C, auto/OFF, Ti24 interface

Characteristics		Value
Capacity of indication contacts (O/C, auto/OFF terminal blocks)	minimum	100 mA
	maximum	1 A
Maximum capacity of O/C, auto/OFF outputs (Ti24 interface)		100 mA

NOTE: (Filtering) The O/C and auto/OFF contacts may change state for less than 10 ms. These brief changes of state (bounce) must not be taken into account and must be filtered by a device external to the Reflex iC60 circuit breaker.

Dimensions

The dimensions of the Reflex iC60 integrated control circuit breaker, optionally assembled with a Vigi iC60 are as follows:



The widths of the Vigi iC60 auxiliaries are as follows:

Auxiliary	Type	Width
Vigi iC60	2P	36 mm
	3P	54 mm
	4P	72 mm

Chapter 4

Installation

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Assembly, Installation and Dismantling	20
Connection	25

Assembly, Installation and Dismantling

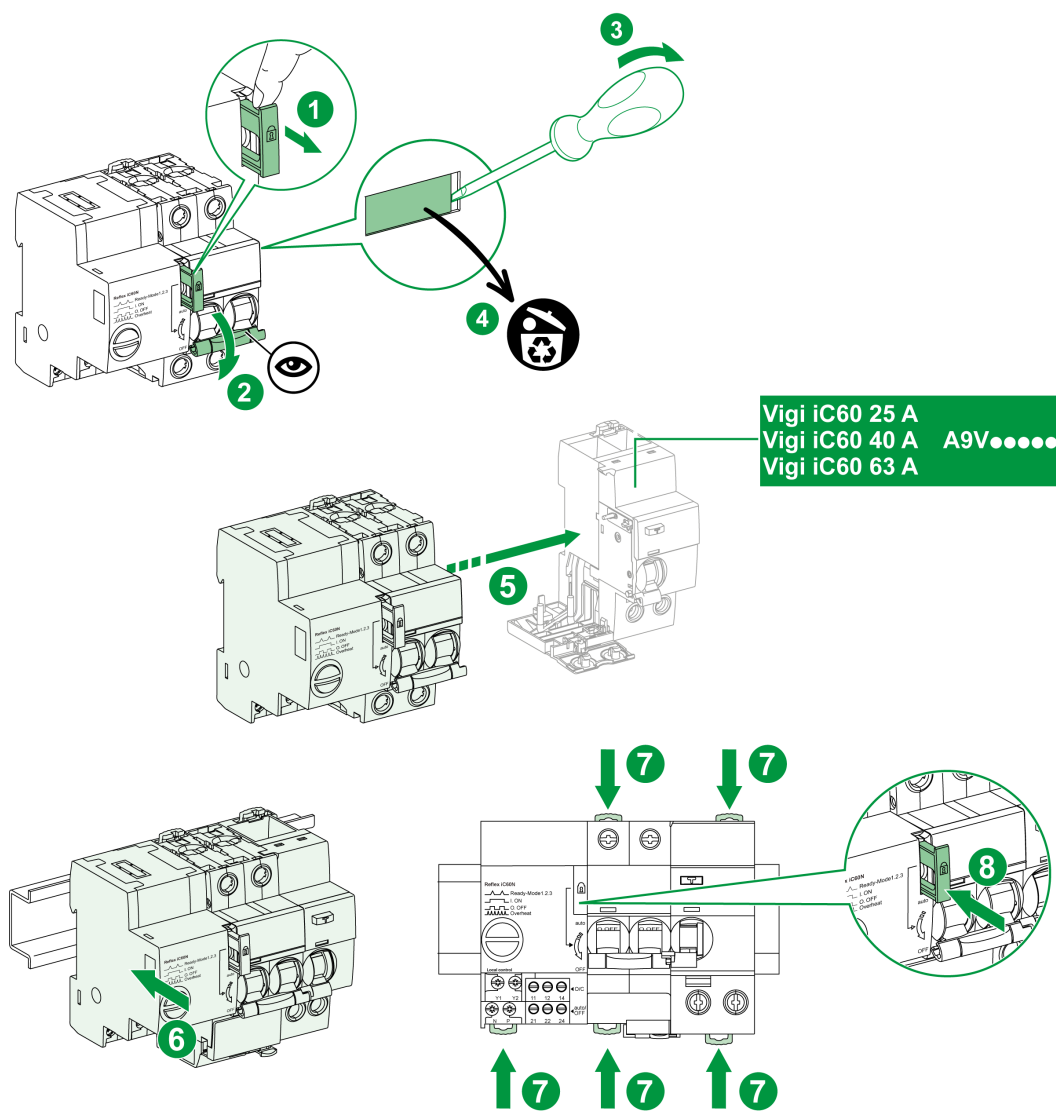
Introduction

A Vigi iC60 optional auxiliary can be added to the Reflex iC60 integrated control circuit breaker.

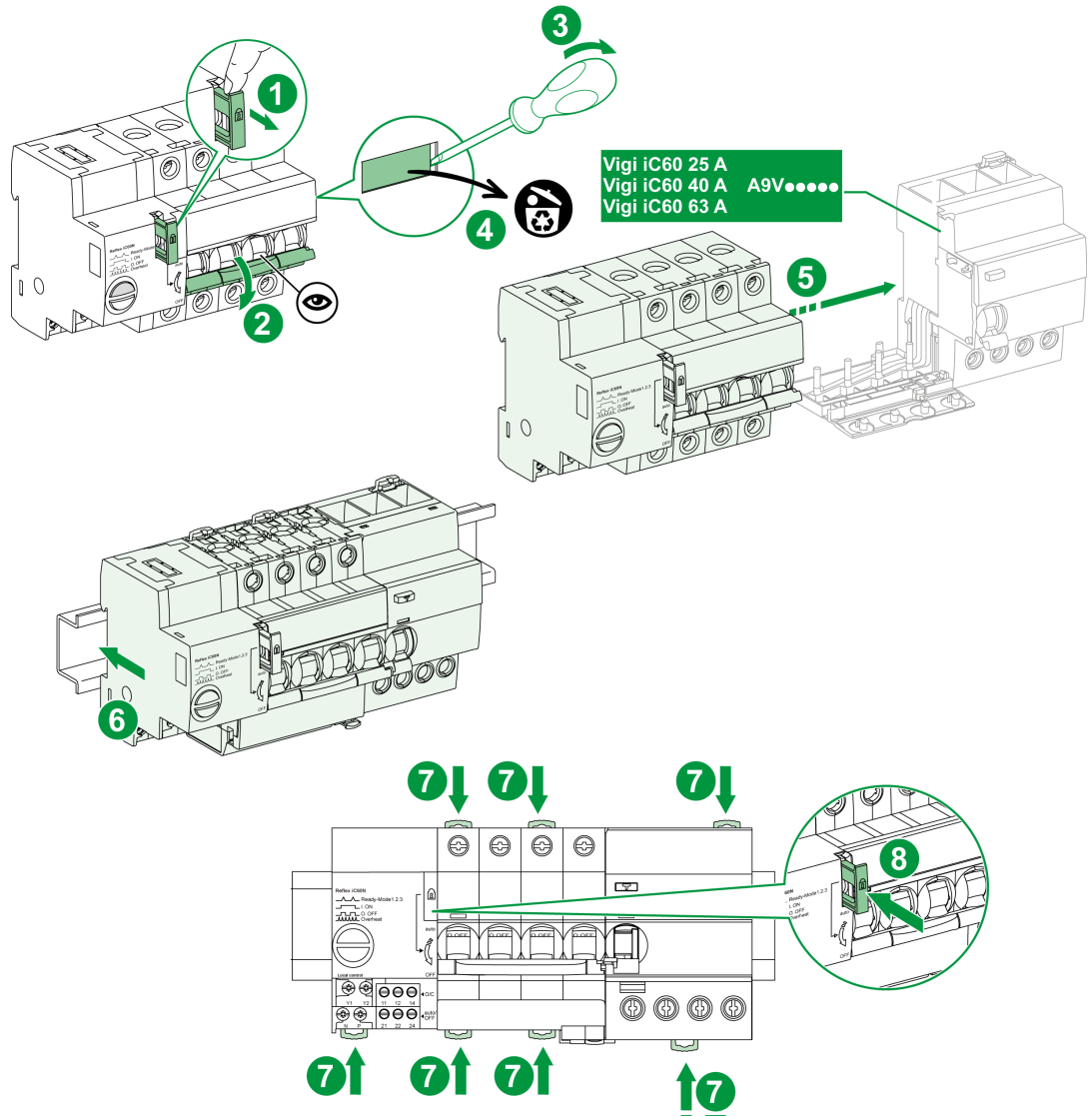
Assembly and Installation Procedure with Vigi iC60 A9V..... Auxiliary

Step	Action
1	Pull out the padlocking device.
2	Check that the handle is in OFF position (circuit breaker open).
3	Remove the blanking plate on the right-hand side of the Reflex iC60 circuit breaker using a screwdriver.
4	Recycle the blanking plate.
5	Assemble the Vigi iC60 auxiliary with the Reflex iC60 circuit breaker.
6	Place the assembly on the DIN rail.
7	Push in the locking clips.
8	Push the padlocking device back in.

Reflex iC60 2P



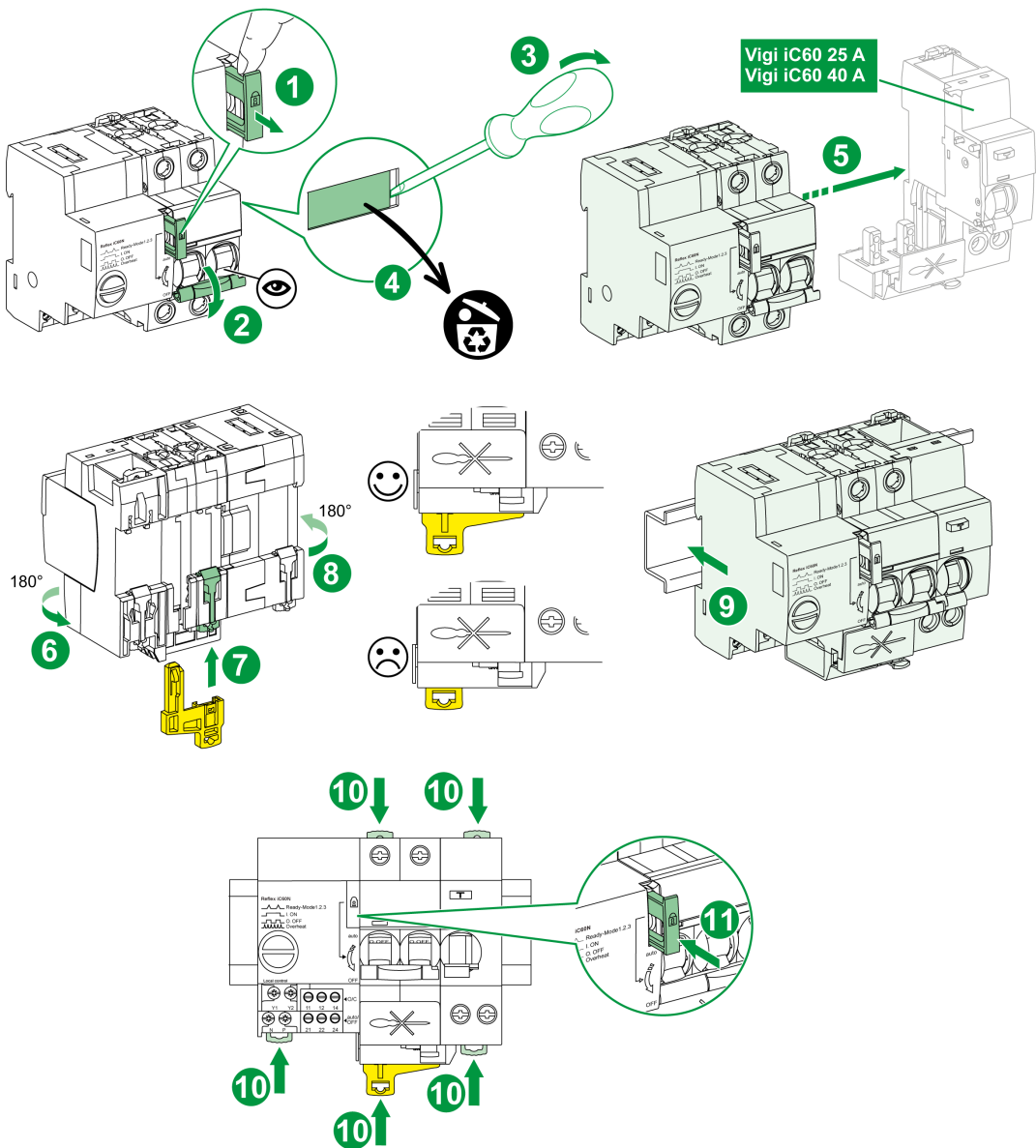
Reflex iC60 3P/4P



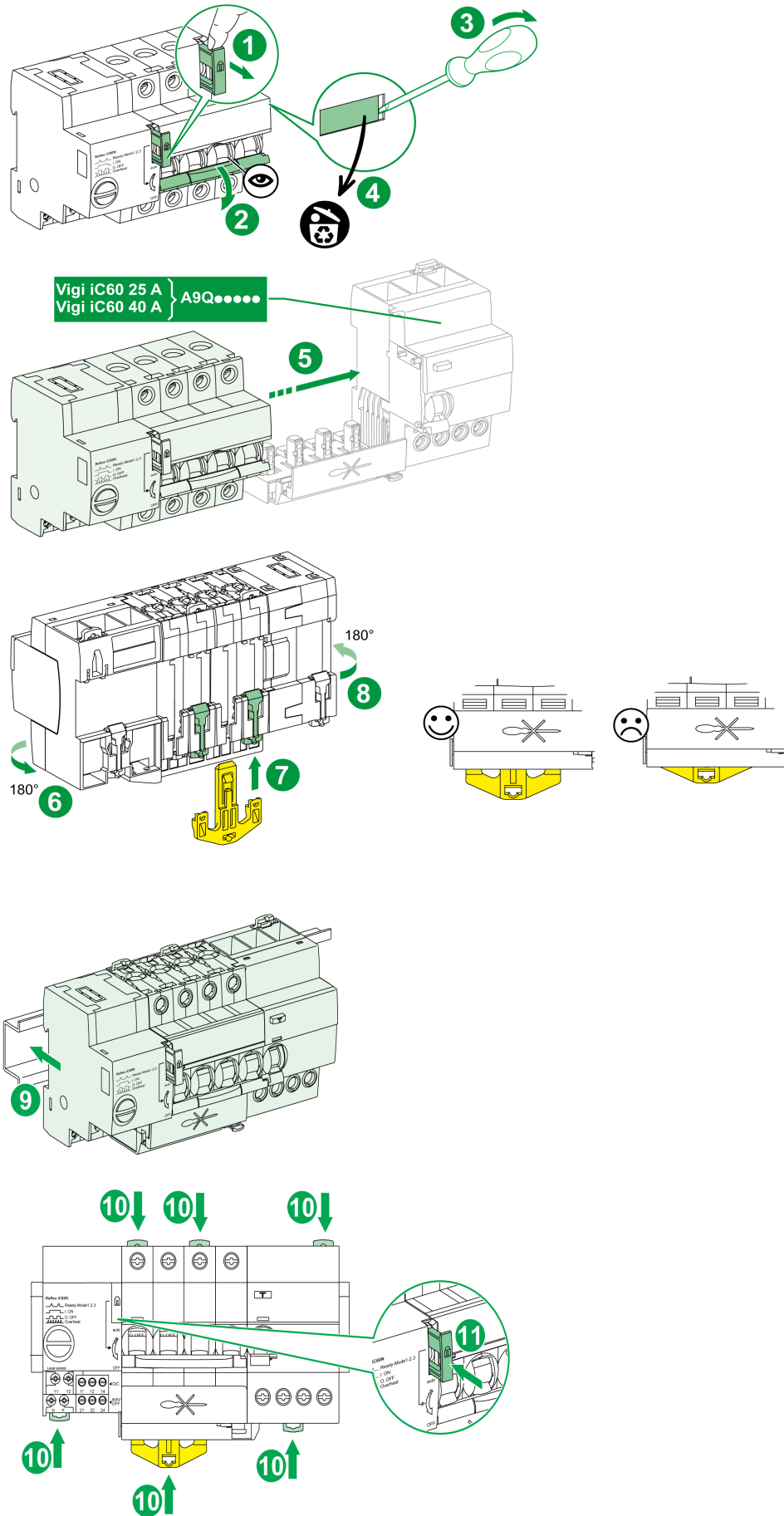
Assembly and Installation Procedure with Vigi iC60 A9Q..... Auxiliary

Step	Action
1	Pull out the padlocking device
2	Check that the handle is in OFF position (circuit breaker open)
3	Remove the blanking plate on the right-hand side of the Reflex iC60 circuit breaker using a screwdriver.
4	Recycle the blanking plate.
5	Assemble the Vigi iC60 auxiliary with the Reflex iC60 circuit breaker
6	Pivot the assembly 180° in relation to the vertical axis.
7	On the back of the assembly, install the yellow clip (locking extension on the Reflex iC60 DIN rail).
8	Pivot the assembly 180° in relation to the vertical axis.
9	Place the assembly on the DIN rail.
10	Push in the locking clips.
11	Push the padlocking device back in

Reflex iC60 2P

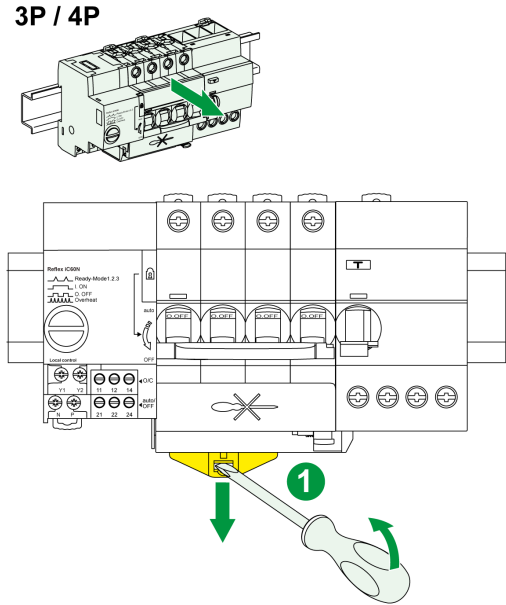
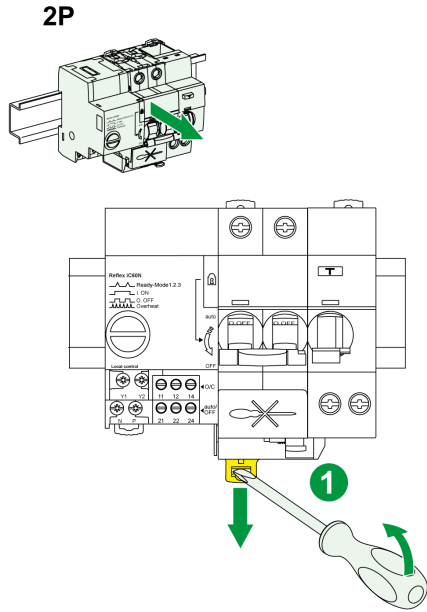


Reflex iC60 3P/4P

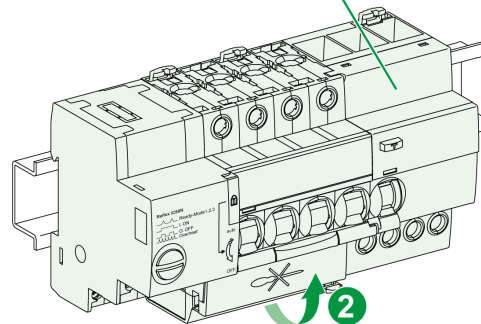
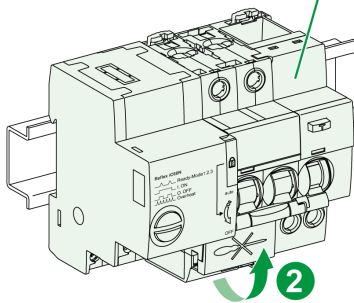


Dismantling Procedure

Step	Action
1	Using a screwdriver, pull down the yellow clip (locking extension on the Reflex iC60 DIN rail) located underneath the Reflex iC60.
2	Pivot the Reflex iC60 upwards to remove it from the DIN rail.



Vigi iC60 25 A } A9Q●●●●
 Vigi iC60 40 A }



Connection

Safety Instructions

⚡ ⚠ **DANGER**

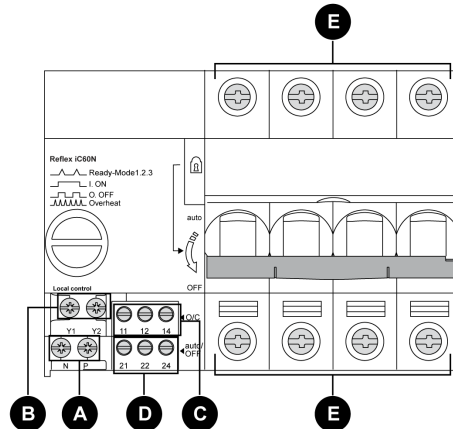
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Wear appropriate personal protective equipment and follow the standard electrical safety precautions.
- Only qualified electricians who have read the relevant instructions are authorized to install this equipment.
- NEVER work alone.
- Disconnect all current and voltage sources before carrying out visual inspections, testing or maintenance work on this equipment. Always assume that all circuits are live until they have been de-energized, tested, and labeled. Pay particular attention to the design of the power supply circuit. Take account of all power supply sources, including in particular feedback possibilities.
- Before closing the covers and doors, carefully inspect the working area to ensure that no tools or other items have been left inside the equipment.
- Take care when removing or replacing panels. In particular, make sure that they do not touch live busbars. To minimize the risk of injury, avoid handling panels.
- If this equipment is to remain in good working order it must be handled, installed, and operated correctly. Failure to comply with basic installation instructions may lead to injury and may damage the electrical equipment or other property.
- NEVER shunt an external fuse/circuit breaker.
- This equipment must be installed inside a suitable electrical cabinet.

Failure to follow these instructions will result in death or serious injury.

Connection Blocks of Reflex iC60 without Ti24 Interface

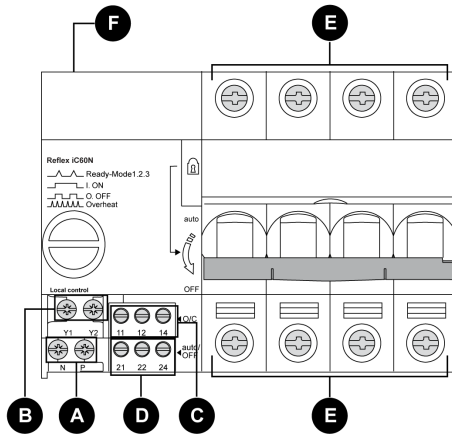
The following diagram shows the five connection blocks of a Reflex iC60 integrated control circuit breaker without Ti24 interface.



- A 230 Vac power supply terminal block
- B Y1/Y2 control input terminal block
- C Terminal block with control circuit state indication contacts (O/C contacts)
- D Terminal block with circuit breaker state indication contacts (auto/OFF contacts)
- E Isolated terminals

Connection Blocks of Reflex iC60 with Ti24 Interface

The following diagram shows the six connection blocks of a Reflex iC60 integrated control circuit breaker with Ti24 interface.



- A 230 Vac power supply terminal block
- B Y1/Y2 control input terminal block
- C Terminal block with control circuit state indication contacts (O/C contacts)
- D Terminal block with circuit breaker state indication contacts (auto/OFF contacts)
- E Isolated terminals
- F Ti24 interface

Description of the Terminals and the Ti24 Interface

A 230 Vac power supply terminal block

Terminal	Function
N	Neutral
P	Phase

B Y1/Y2 control input terminal block

Terminal	Function
Y1	Mode 1: local closing control on rising edge and opening control on falling edge Mode 2: local opening control on rising edge, latched at high state (state = 1) to inhibit Y2 Mode 3: centralized control enabled (Y1 = 1) or centralized control inhibited (Y1 = 0)
Y2	Mode 1: local one-shot closing and opening control Mode 2: local one-shot closing and opening control Mode 3: local one-shot closing and opening control

C Terminal block with control circuit state indication contacts (O/C contacts)

Terminals	Contact	Function
11–12	NC (normally closed)	Circuit breaker state: closed
11–14	NO (normally open)	Circuit breaker state: open

D Terminal block with circuit breaker state indication contacts (auto/OFF contacts)

Terminals	Contact	Function
21–22	NC (normally closed)	Circuit breaker state: closed
21–24	NO (normally open)	Circuit breaker state: open following tripping

E Isolated terminals

Terminals	Function
0.5..0.63 A	Power depending on the Reflex iC60 rating

F Ti24 interface

Terminal	Function
0 V	0 Vdc power supply
O/C	Control circuit state indication: <ul style="list-style-type: none"> ● O/C closed: the contacts are closed. ● O/C open: the contacts are open.
auto/OFF	Circuit breaker state indication: <ul style="list-style-type: none"> ● auto/OFF closed: the circuit breaker handle is in the auto position. ● auto/OFF open: the circuit breaker handle is in the OFF position.
Y3	Mode 1: centralized closing control on rising edge and opening control on falling edge Mode 2: centralized closing control on rising edge and opening control on falling edge Mode 3: centralized closing control on rising edge and opening control on falling edge
24 V	24 Vdc power supply

Connection Characteristics

Item	Terminal block	Tightening torque	Stripping length	Wire size			
				Solid	Flexible	Flexible with ferrule	2 cables
A	Power supply (230 Vac)	1 N.m	10 mm	1...10 mm ²	1...6 mm ²	0.5...4 mm ²	≤ 2 x 1.5 mm ² ≤ 2 x 2.5 mm ²
B	Inputs Y1/Y2						
C	Output O/C	0.7 N.m	8 mm	1...2.5 mm ²	0.5...2.5 mm ²	0.5...1.5 mm ²	≤ 2 x 1.5 mm ²
D	Output auto/OFF						
E	10 A, 16 A, 25 A	2 N.m	14 mm	1...25 mm ²	0.5..0.16 mm ²		≤ 5 x 1.5 mm ² ≤ 3 x 2.5 mm ² ≤ 2 x 1.5 mm ² +
	40 A, 63 A	3.5 N.m		1...35 mm ²	0.5...25 mm ²		≤ 5 x 4 mm ² ≤ 3 x 6 mm ² ≤ 2 x 4 mm ² + ≤ 1 x 6 mm ²

Connection Diagram of Reflex iC60 without Ti24 Interface

NOTICE

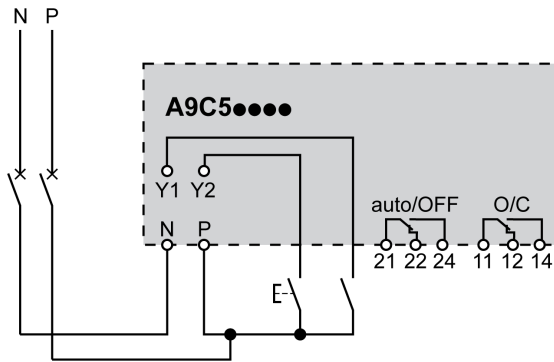
RISK OF MALFUNCTION

- In three-phase applications, use the same phase to connect the power supply and inputs Y1 and Y2.
- Keep to the recommended minimum power for the Reflex iC60 integrated control circuit breaker power supply.

Failure to follow these instructions can result in equipment damage.

The following diagrams illustrate the connection options.

The following diagram illustrates connection of a Reflex iC60 integrated control circuit breaker, without Ti24 interface:



Connection Diagrams of Reflex iC60 with Ti24 Interface

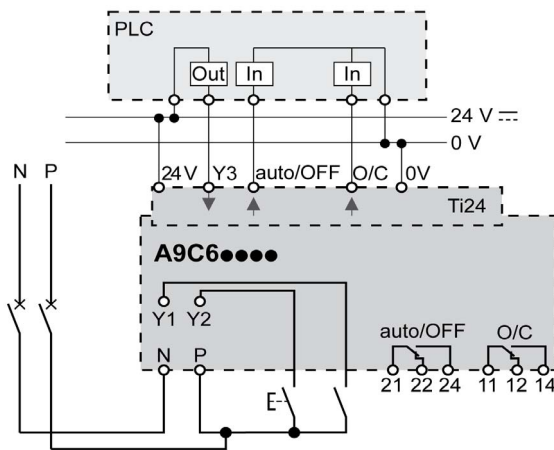
NOTICE

RISK OF MALFUNCTION

- In three-phase applications, use the same phase to connect the power supply and inputs Y1 and Y2.
- Keep to the recommended minimum power for the Reflex iC60 integrated control circuit breaker power supply.

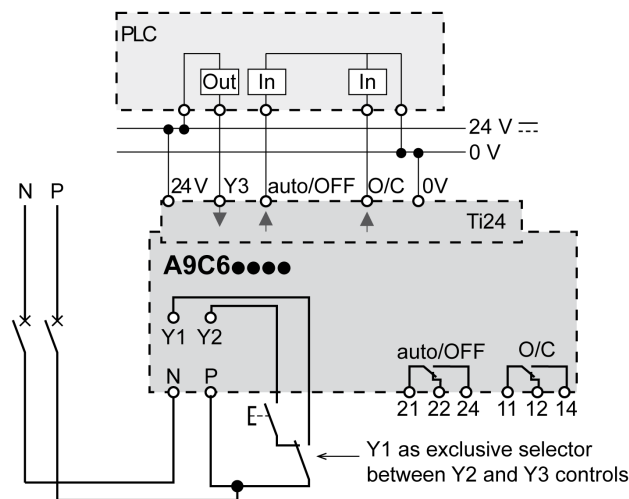
Failure to follow these instructions can result in equipment damage.

The following diagram illustrates connection of a Reflex iC60 integrated control circuit breaker, with Ti24 interface:



Specific connection diagram

The following diagram illustrates connection of a Reflex iC60 integrated control circuit breaker, with Ti24 interface, used in mode 3, with Y1 as exclusive selector between controls Y2 and Y3:



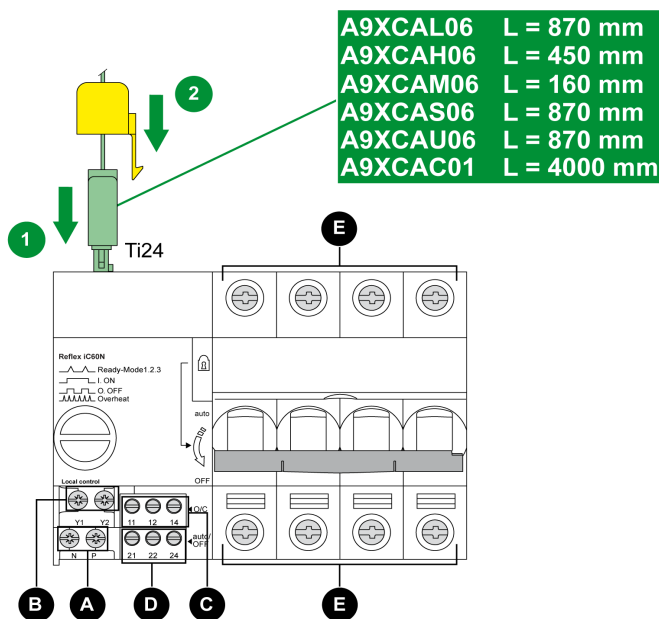
Connection of the Ti24 Interface

NOTICE

RISK OF NON-OPERATION OF THE REFLEX A9C60000 PRODUCT

- Fully insert the Ti24 communication cable (item 1) into the Reflex iC60 connector.
- Lift the clip (item 2) and insert it into the notch on the Reflex iC60 product to lock the communication cable in place.

Failure to follow these instructions can result in equipment damage.



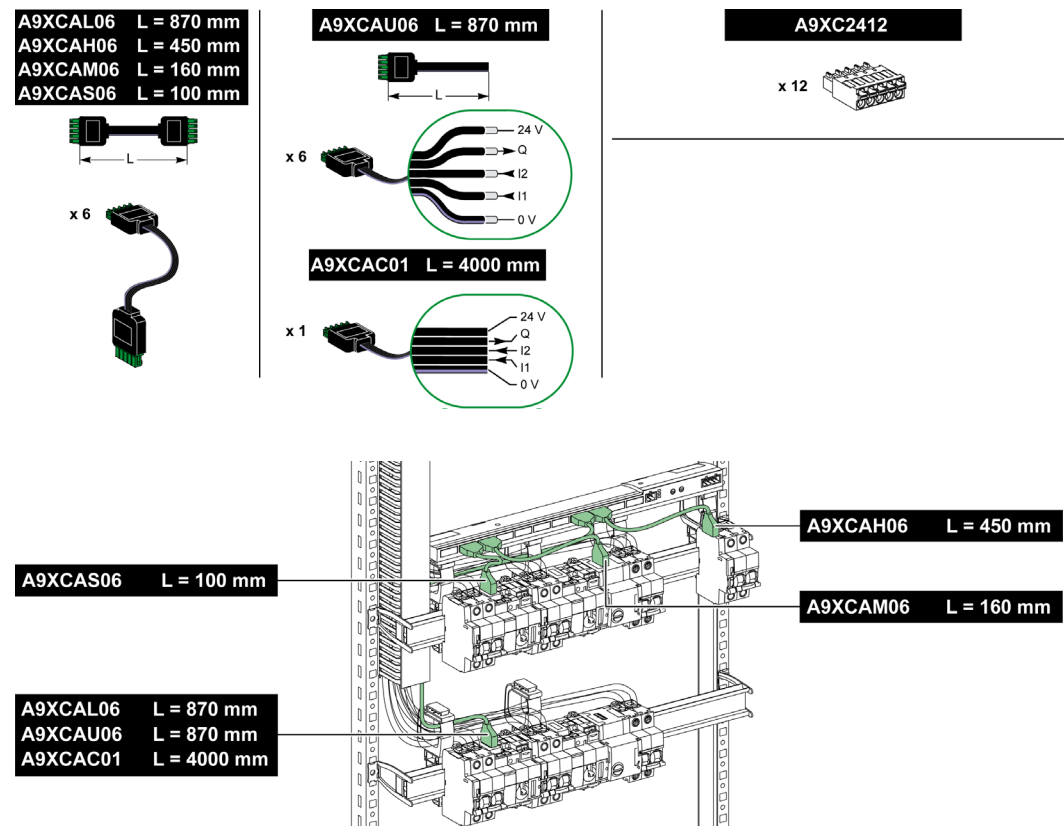
Description of the Acti 9 Communication System Pre-assembled Cables

Acti 9 communication pre-assembled cables are a very quick way to connect all the Acti 9 communication system components and compatible products (24 Vdc) to the channels of an Acti 9 Smartlink module.

The pre-assembled cables are:

Product Reference	Description	Length (mm)
A9XCAS06	Set of six pre-assembled cables with two Ti24 connectors	100
A9XCAM06	Set of six pre-assembled cables with two Ti24 connectors	160
A9XCAH06	Set of six pre-assembled cables with two Ti24 connectors	450
A9XCAL06	Set of six pre-assembled cables with two Ti24 connectors	870
A9XCAU06	Set of six pre-assembled cables with one Ti24 connector	870
A9XCAC01	One pre-assembled cable with one Ti24 connector	4,000
A9XC2412	Set of 12 connectors with 5-pin spring	-

Each Ti24 interface (I/O channel) is compatible with Miniconnect Phoenix standard connectors (at intervals of 3.81 mm) or equivalent.



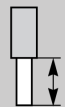


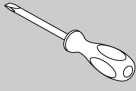
NOTE: The connectors in each pre-assembled cable have a flat surface where a self-adhesive label can be placed to identify the channel number used. Self-adhesive labels are not supplied by Schneider Electric.

Description of the Connector at the Ti24 Interface End	
Terminal	Description
24 V	24 V of the 24 Vdc power supply
Q	Control output
I2	Input number 2
I1	Input number 1
0 V	0 V of the 24 Vdc power supply

NOTE:

- Do not connect two wires in each of the Ti24 connector terminals (A9XC2412).
- Do not connect a wire with cable end in each of the Ti24 connector terminals.

The table shows the characteristics of cables that can be used with the A9XC2412 connector:

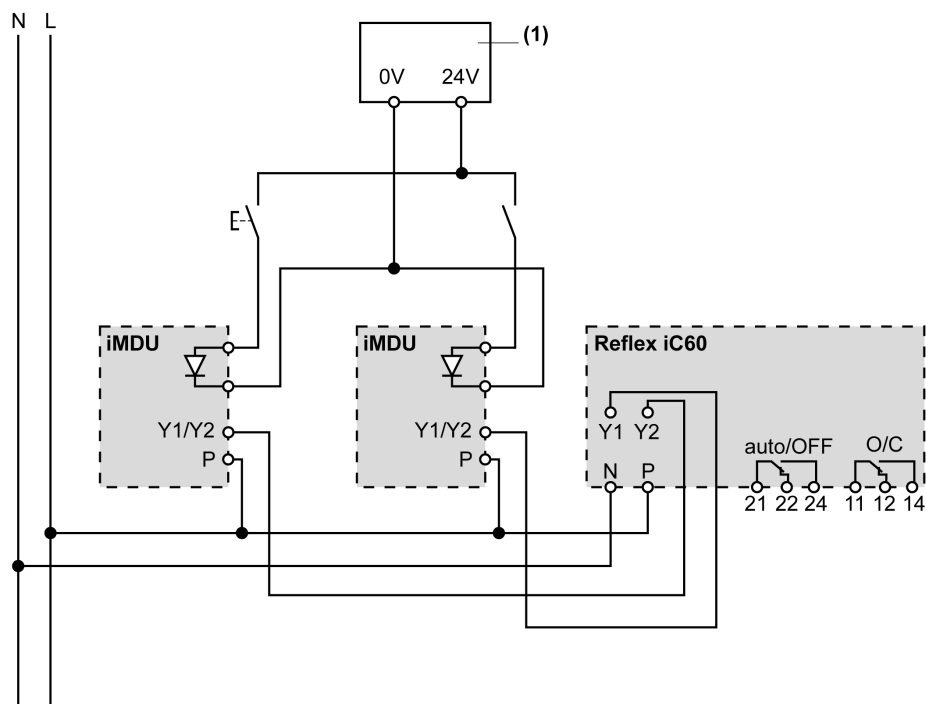
			
10 mm	0.5...1.5 mm ²		0.4 x 2.5

Supplying the Control Inputs Using an iMDU Auxiliary



The Y1/Y2 control inputs on Reflex iC60 integrated control circuit breakers operate at 230 Vac voltage. An iMDU auxiliary is used to control a Reflex iC60 integrated control circuit breaker via a 24/48 Vac/dc output.

The following diagram illustrates connection of the control inputs on a Reflex iC60 integrated control circuit breaker using iMDU auxiliaries:



1 24/48 Vdc or 24/48 Vac power supply, for example: 24 Vdc

The catalog number for the iMDU auxiliary is available in the relevant section ([see page 11](#)).

Chapter 5

Use

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Operating Modes	34
Selection of the Operating Mode	40
Automatic Overheat Protection for the Reflex iC60 Integrated Control Circuit Breaker	42
Operation	43
Diagnostics	46

Operating Modes

Introduction

All versions of the Reflex iC60 integrated control circuit breaker, with and without Ti24 interface, have two control inputs (Y1 and Y2). In addition, the version with Ti24 interface has an additional control input (Y3) dedicated to control from a PLC.

The Reflex iC60 version without Ti24 interface has two operating modes: mode 1 and mode 2. Mode 1 is the default mode.

The Reflex iC60 version with Ti24 interface has three operating modes: mode 1, mode 2 and mode 3. Mode 3 is the default mode.

Reflex iC60 integrated control circuit breaker functions

The following table describes the available functions according to the type of Reflex iC60 circuit breaker.

Mode	Function	Input	A9C5**** (without Ti24)	A9C6**** (with Ti24)
1	Local closing control on rising edge and opening control on falling edge	Y1	√	√
	Local one-shot closing and opening control	Y2	√	√
	Centralized closing control on rising edge and opening control on falling edge (conforming to standard IEC 61131-2)	Y3	–	√
2	Local opening control on rising edge, latched at high state (state = 1) to inhibit local one-shot closing and opening control	Y1	√	√
	Local one-shot closing and opening control	Y2	√	√
	Centralized closing control on rising edge and opening control on falling edge (conforming to standard IEC 61131-2)	Y3	–	√
3	Centralized control enabled (Y1 = 1) or centralized control inhibited (Y1 = 0)	Y1	√	√
	Local one-shot closing and opening control	Y2	√	√
	Centralized closing control on rising edge and opening control on falling edge (conforming to standard IEC 61131-2)	Y3	–	√

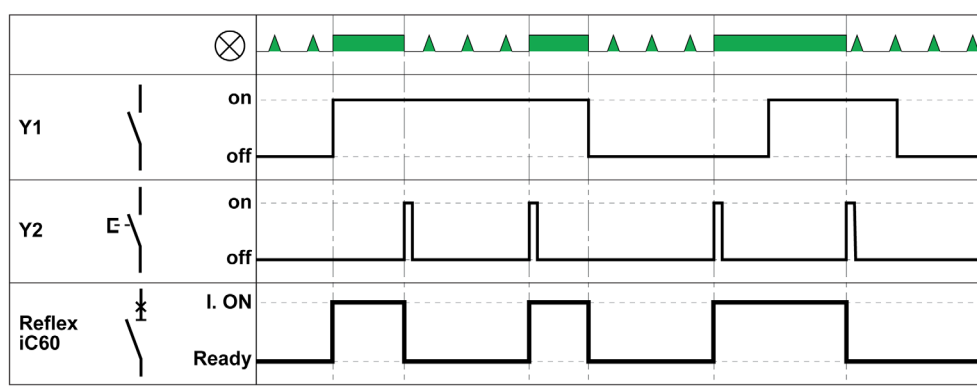
Mode 1

Mode 1 is used for local or centralized opening/closing of the circuit breaker. The commands come from different control points and are executed in the order in which they arrive:

- Y1: local closing control on rising edge and opening control on falling edge
- Y2: local one-shot closing and opening control
- Y3: centralized closing control on rising edge and opening control on falling edge

NOTE: Y3 is only available in Reflex iC60 versions with Ti24 interface.

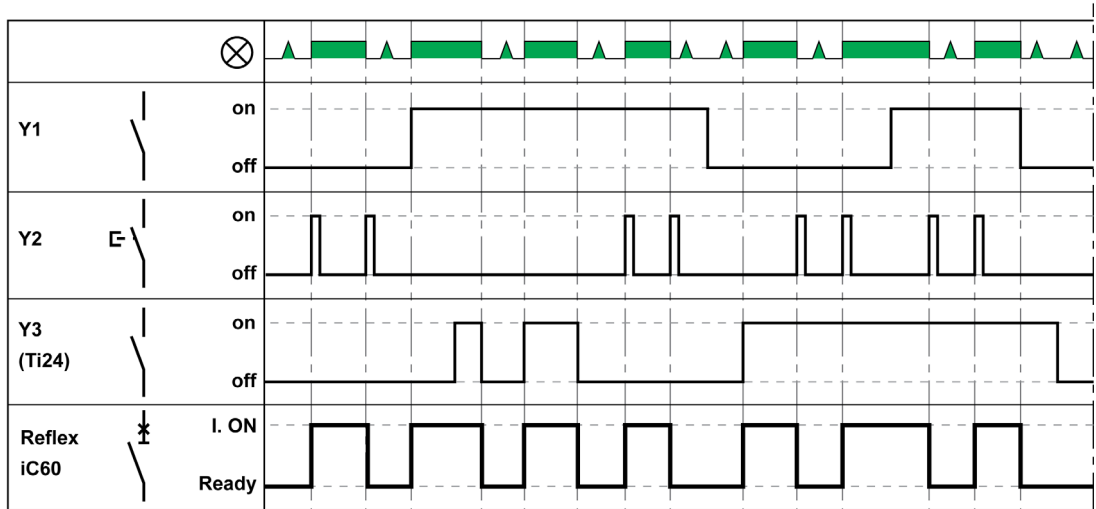
The following diagram shows operation of the version without Ti24 interface.



Operation is as follows:

- When input Y1 changes to 1, the Reflex iC60 circuit breaker switches to closed position
- When input Y1 changes to 0, the Reflex iC60 circuit breaker switches to **Ready** position (contacts open)
- A pulse on input Y2 makes the Reflex iC60 circuit breaker switch alternately from **Ready** position (contacts open) to closed position

The following diagram shows mode 1 operation of versions with Ti24 interface.



Operation is as follows:

- When input Y1 or input Y3 (Ti24) changes to 1, the Reflex iC60 circuit breaker switches to closed position
- When input Y1 or input Y3 (Ti24) changes to 0, the Reflex iC60 circuit breaker switches to **Ready** position (contacts open)
- A pulse on input Y2 makes the Reflex iC60 circuit breaker switch alternately from **Ready** position (contacts open) to closed position

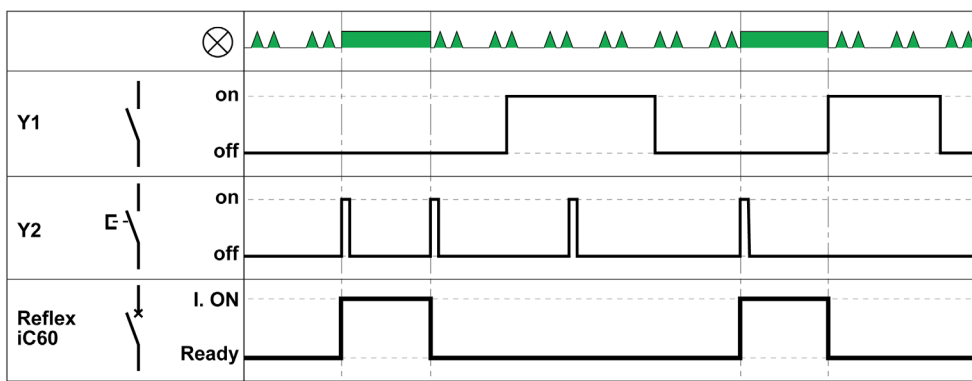
Mode 2

Mode 2 is used for local opening/closing and centralized opening of the circuit breaker:

- Y1: local opening control on rising edge, latched at high state (state = 1) to inhibit Y2
- Y2: local one-shot closing and opening control
- Y3: centralized closing control on rising edge and opening control on falling edge

NOTE: Y3 is only available in Reflex iC60 versions with Ti24 interface.

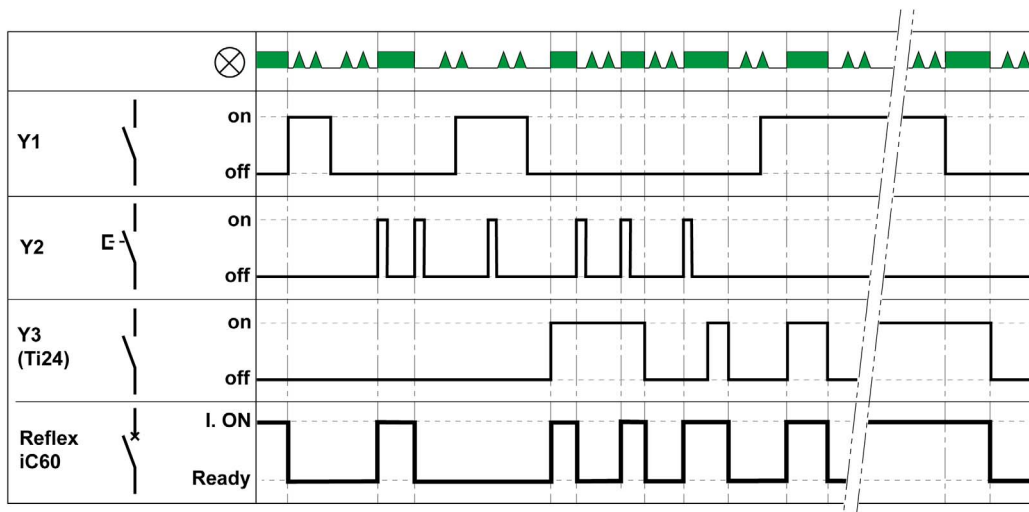
The following diagram shows operation of the version without Ti24 interface.



Operation is as follows:

- When input Y1 is at 1, input Y2 is inhibited
- When input Y1 is at 0, a pulse on input Y2 makes the Reflex iC60 circuit breaker switch alternately from **Ready** position (contacts open) to closed position

The following diagram shows mode 2 operation of versions with Ti24 interface.



Operation is as follows:

- A rising edge on input Y1 makes the Reflex iC60 circuit breaker switch to **Ready** position (contacts open)
- The state of input Y3 is taken into account on falling edge of Y1. If input Y3 is at 1 when there is a falling edge on Y1 the Reflex iC60 circuit breaker switches to closed position
- Input Y2 is inhibited when input Y1 is at 1
- If input Y1 is at 0, a pulse on input Y2 (rising edge) makes the Reflex iC60 circuit breaker switch alternately from **Ready** position (contacts open) to closed position
- Input Y3 (Ti24) is operational if Y1 is at 1 or at 0:
 - When input Y3 (Ti24) changes to 1, the Reflex iC60 circuit breaker switches to closed position
 - When input Y3 (Ti24) changes to 0, the circuit breaker switches to **Ready** position (contacts open)

Mode 3

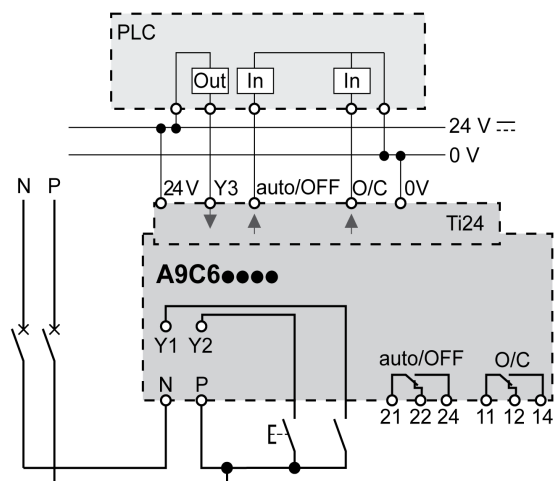
Mode 3 can be used with two different connection diagrams.

The behavior of the control inputs is specific to each connection diagram.

Connection diagram 1

The following connection diagram enables the Reflex iC60 circuit breaker to optionally use (depending on the state of input Y1) the controls on input Y3.

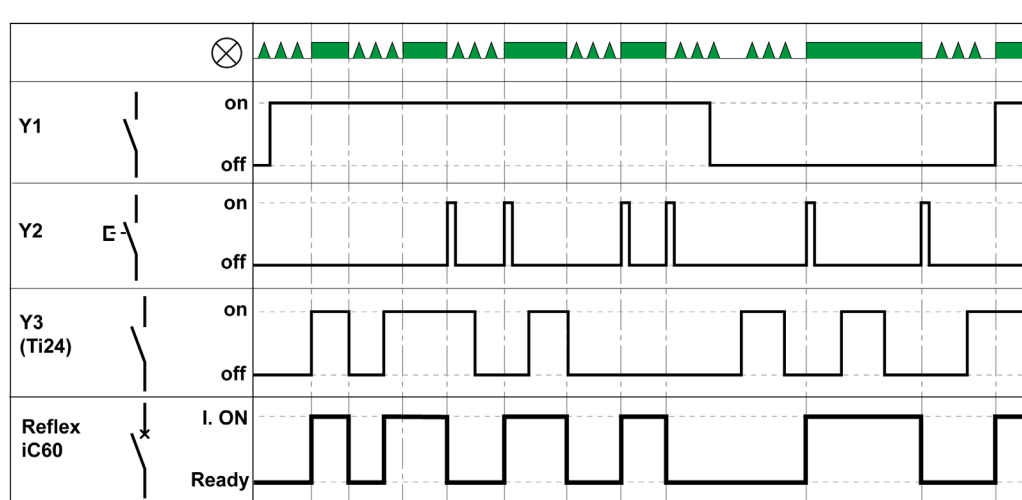
The controls on input Y2 are still taken into account by the Reflex iC60 circuit breaker.



Mode 3 is used for centralized opening or closing of the circuit breaker and local override:

- Y1: centralized control enabled (Y1 = 1) or centralized control prohibited (Y1 = 0)
- Y2: local one-shot closing and opening control
- Y3: centralized closing control on rising edge and opening control on falling edge

The following diagram shows mode 3 operation.



Operation is as follows:

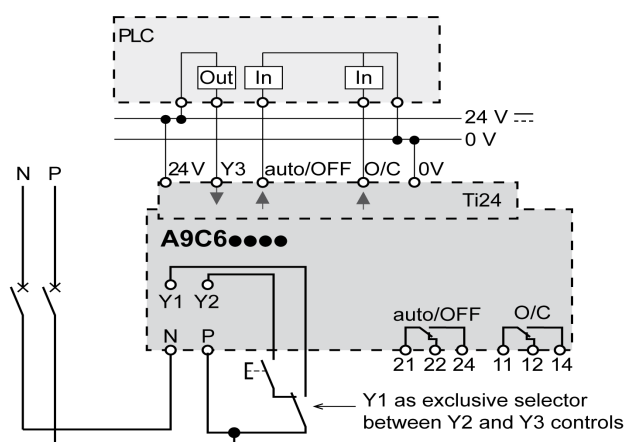
- When input Y1 is at 0:
 - input Y3 (centralized control via Ti24) is ineffective
 - Input Y2 is operational (local control):
A pulse on input Y2 (rising edge) makes the Reflex iC60 circuit breaker switch alternately from **Ready** position (contacts open) to closed position

- When input Y1 is at 1:
 - Input Y3 (centralized control via Ti24) is operational:
 - When input Y3 (Ti24) changes to 1, the Reflex iC60 circuit breaker switches to closed position
 - When input Y3 (Ti24) changes to 0, the Reflex iC60 circuit breaker switches to **Ready** position (contacts open)
 - Input Y2 is operational (local control):
 - A pulse on input Y2 (rising edge) makes the Reflex iC60 circuit breaker switch alternately from **Ready** position (contacts open) to closed position
- The state of input Y3 is taken into account on rising edge of Y1:
 - If input Y3 is at 1 when there is a rising edge on Y1 the Reflex iC60 circuit breaker switches to closed position.

Connection diagram 2

The following connection diagram is based on a selector (input Y1) so that the Reflex iC60 circuit breaker uses, in exclusive mode, the controls:

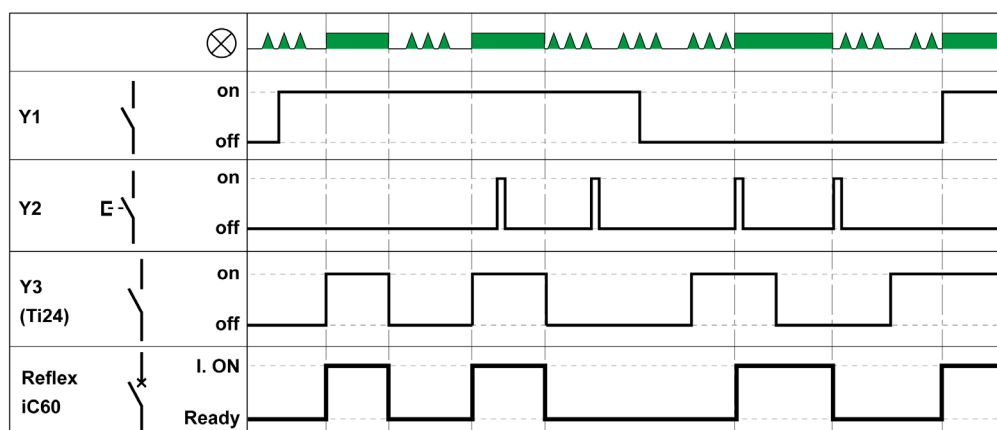
- On input Y2 (in this case, controls on input Y3 are ineffective)
- On input Y3 (in this case, controls on input Y2 are ineffective)



Mode 3 is used for centralized opening/closing of the circuit breaker and local override:

- local control selector (Y1 = 0) and centralized control (Y1 = 1)
- Y2: local one-shot closing and opening control
- Y3: centralized closing control on rising edge and opening control on falling edge

The following diagram shows mode 3 operation.



Operation is as follows:

- When input Y1 is at 0, input Y2 is operational (local control) and input Y3 (centralized control via Ti24) is ineffective
- When input Y1 is at 1, input Y2 is ineffective (local control) and input Y3 (centralized control via Ti24) is operational
- A pulse on input Y2 makes the Reflex iC60 circuit breaker switch alternately from **Ready** position (contacts open) to closed position
- When input Y3 (Ti24) changes to 1, the Reflex iC60 circuit breaker switches to closed position
- When input Y3 (Ti24) changes to 0, the Reflex iC60 circuit breaker switches to **Ready** position (contacts open)

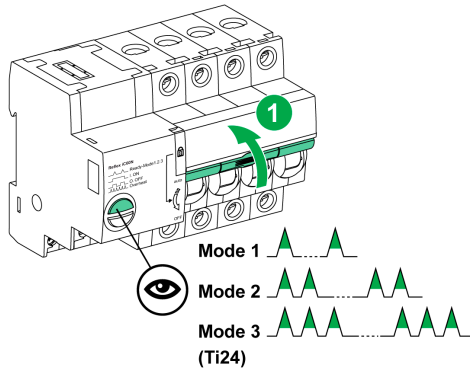
Selection of the Operating Mode

Checking the Operating Mode

To check the operating mode of the Reflex iC60 circuit breaker, the handle must be in the upper position (auto).

The LED indicates the operating mode:

- Mode 1: the LED flashes once green
- Mode 2: the LED flashes twice green
- Mode 3: the LED flashes three times green



NOTE: Selection of the operating mode is described in the next paragraph.

Default setting

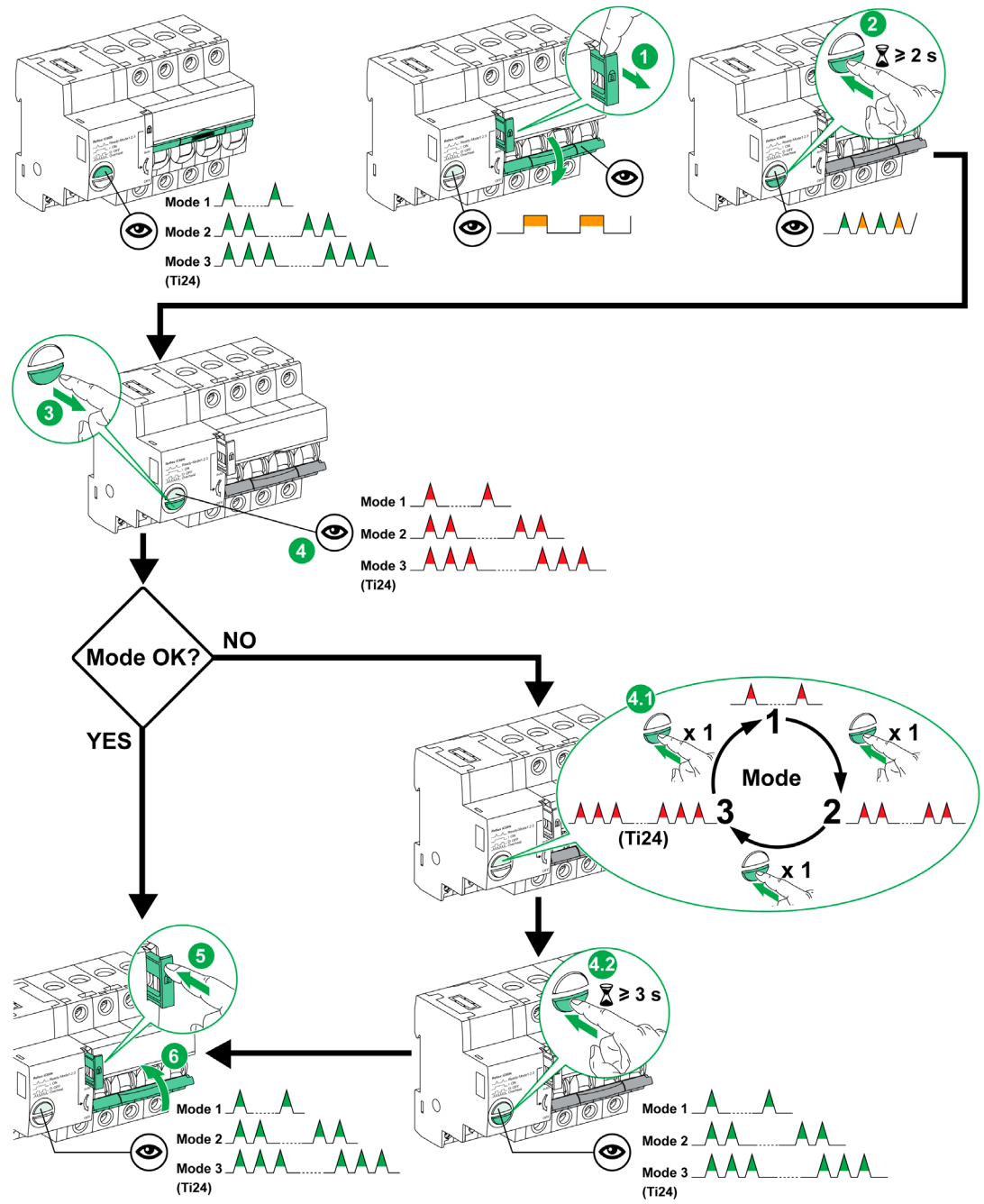
Reflex iC60 circuit breaker type	Default setting
A9C5****	Mode 1
A9C6****	Mode 3

Selection of the Operating Mode

The circuit breaker's operating mode is selected using the manual control pushbutton on the circuit breaker.

The following procedure describes the actions to be performed to select the operating mode of the Reflex iC60 circuit breaker.


Step	Action
1	Pull out the padlocking device to set the handle on the circuit breaker to OFF position.
2	Press the pushbutton on the Reflex iC60 circuit breaker for at least 3 seconds so that the LED flashes alternately green and orange.
3	The LED indicates the active operating mode: <ul style="list-style-type: none"> • Mode 1: the LED flashes once red • Mode 2: the LED flashes twice red • Mode 3: the LED flashes three times red NOTE: Mode 3 is only available for integrated control circuit breakers with Ti24 interface.
4	Press the pushbutton several times in succession to select the required operating mode. Each press switches the circuit breaker from one mode to the next.
5	Once the operating mode is selected, press the pushbutton on the Reflex iC60 circuit breaker for at least 3 seconds to confirm the chosen mode. The LED indicates the selected operating mode: <ul style="list-style-type: none"> • Mode 1: the LED flashes once green • Mode 2: the LED flashes twice green • Mode 3: the LED flashes three times green NOTE: Mode 3 is only available for integrated control circuit breakers with Ti24 interface.
6	Push the padlocking device back in and close the circuit breaker by placing the handle in the upper position (auto).




Automatic Overheat Protection for the Reflex iC60 Integrated Control Circuit Breaker

Description

If the Reflex iC60 integrated control circuit breaker receives too many control orders in too short a time period, overheat protection is automatically activated (Overheat) to limit the device's potential temperature rise and maintain its service life.

Remote control is then not possible and the status LED flashes rapidly orange. 

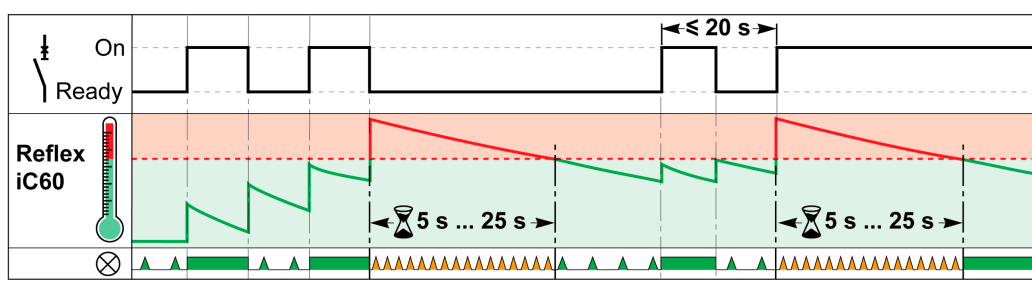
This safety feature is automatically disabled when the device's estimated temperature returns to a satisfactory level. Control is then possible again. The status LED flashes green. 

Operating Principle

The Reflex iC60 integrated control circuit breaker does not incorporate an internal temperature sensor. Its temperature therefore cannot be measured; it can only be estimated by an algorithm that takes account of the following criteria:

- The frequency of control orders
- The cooling time between two control orders

The following diagram shows how overheat protection works on the Reflex iC60 integrated control circuit breaker.



If the time between two commands is less than 20 seconds, the Reflex iC60 integrated control circuit breaker is likely to switch to automatic overheat protection for a period of 5...25 seconds.

Activation of Overheat Protection

During normal operation of the Reflex iC60, overheat protection will hardly ever be activated, since circuit breaker control does not require a high number of successive commands.

Overheat protection will be activated more frequently at the time the device is installed, or during the test phase when it needs to be controlled more frequently.

Correct Use of the Reflex iC60 Integrated Control Circuit Breaker

Overheat protection is at its minimum level if the device has not received a control order within 20 minutes. It is then possible to carry out 12 successive contact open or close orders before overheat protection is activated.

The Reflex iC60 can tolerate a rate of one contact opening/closing cycle every 30 seconds. If this frequency increases, overheat protection is likely to activate automatically.








When overheat protection is activated for the first time, it lasts approximately 5 seconds. This duration then increases to allow the device to cool between two successive control orders. The maximum duration for overheat protection is 25 seconds.

NOTE: Cutting the power to the Reflex iC60 does not reset the overheat protection algorithm.

Operation

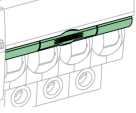

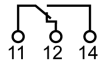
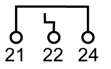

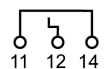
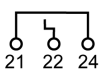

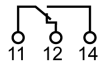
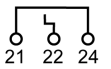

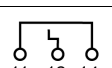
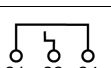
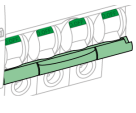
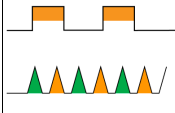
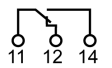
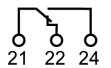
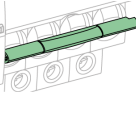

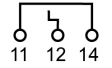
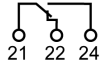
Local Indication (LED)

State of the LED indicator on the Reflex iC60 integrated control circuit breaker with and without Ti24 interface:

LED (item H)	Circuit breaker status
	The integrated control circuit breaker is ready. It is possible to control the closing of the contactor by means of Y1, Y2, Y3 and the pushbutton on the front of the Reflex iC60 circuit breaker.
	The integrated control circuit breaker is closed. It is possible to control the opening of the contactor by means of Y1, Y2, Y3 and the pushbutton on the front of the Reflex iC60 circuit breaker.
	The integrated control circuit breaker is open or tripped. No control (locally by means of the pushbutton or Y1, Y2, Y3) is possible. The following actions are necessary in order to control the circuit breaker: <ul style="list-style-type: none"> ● If the circuit breaker is tripped, the user must: <ul style="list-style-type: none"> ○ Act locally by eliminating the fault downstream of the Reflex iC60 circuit breaker ○ Set the handle to the upper position: auto (I.ON). ● If the circuit breaker is open, the user must: <ul style="list-style-type: none"> ○ Set the handle to the upper position: auto (I.ON).
	Overheat protection of the remote control is active. No control is possible at present.
	It is possible to choose the integrated control circuit breaker operating mode.
	Choice of the integrated control circuit breaker operating mode is in progress.
	Reflex iC60 is in one of the two following states: <ul style="list-style-type: none"> ● The poles of the integrated control circuit breaker are welded. The integrated control circuit breaker is out of order. ● Reflex iC60 locked following three failed opening controls. Refer to the unlocking procedure (see page 46).

Remote Indication

States of the indication outputs on the Reflex iC60 integrated control circuit breaker with and without Ti24 interface:

Handle	LED	Circuit breaker output states				Circuit breaker status
		Circuit breaker with or without Ti24 interface		Circuit breaker with Ti24 interface		
		Terminal block C marking	Terminal block D marking	Terminal block E marking		
		Output O/C	Output auto/OFF	Output O/C	Output auto/OFF	
 <p>auto</p>				0	1	The integrated control circuit breaker is ready. It is possible to control the closing of the contactor by means of Y1, Y2, Y3 and the pushbutton on the front of the Reflex iC60 circuit breaker.
				1	1	The integrated control circuit breaker is closed. It is possible to control the opening of the contactor by means of Y1, Y2, Y3 and the pushbutton on the front of the Reflex iC60 circuit breaker.
				0	1	Overheat protection of the remote control is active. No control is possible at present. The circuit breaker is open
				1	1	Circuit breaker poles welded or Reflex iC60 locked following 3 failed opening controls. Refer to the unlocking procedure (see page 46).
 <p>OFF</p>				0	0	The circuit breaker is open following tripping caused by a fault in the power circuit downstream of the Reflex iC60 circuit breaker. Reflex iC60 is in operation selection mode.
 <p>1 Middle position</p>				1	0	The poles are welded: Reflex iC60 is out of order. This is shown by the absence of the green line which indicates the position of the poles locally on the front of the Reflex iC60 circuit breaker. The green line ensures the physical opening of the contacts and enables work to be carried out on the downstream circuit in complete safety.

NOTE: (Filtering) The O/C and auto/OFF contacts may change state for less than 10 ms. These brief changes of state (bounce) must not be taken into account and must be filtered by a device external to the Reflex iC60 circuit breaker.

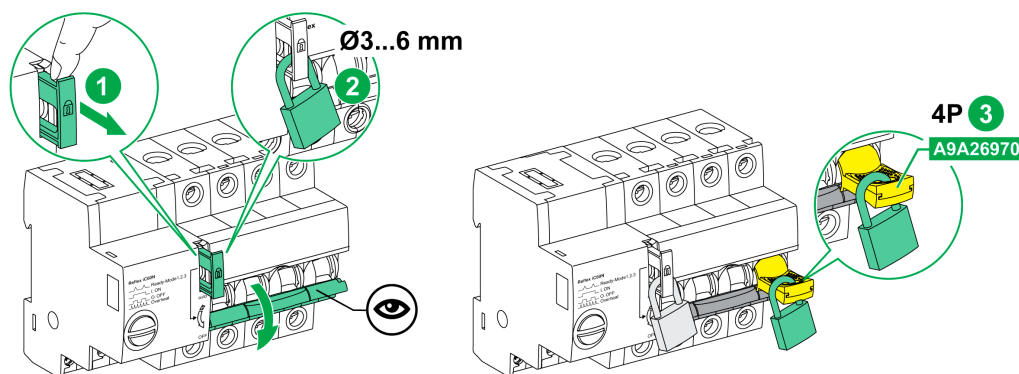
NOTE:

- O/C: Open/Closed contact position.
- auto/OFF: circuit breaker handle position.
- The Reflex iC60 de-energized state (LED off) is indicated by the state of the O/C contact.

Padlocking

This procedure shows how to padlock the integrated control circuit breaker before starting any electrical work. It is impossible to close the circuit breaker either remotely or locally without removing the padlock and pushing in the padlocking device.

Step	Action
1	Pull out the padlocking device from the Reflex iC60 integrated control circuit breaker
2	Attach the padlock (diameter 3...6 mm) to the padlocking device
3	On 3P/4P circuit breaker models attach a second padlock to the circuit breaker using the A9A26970 accessory
4	The integrated control circuit breaker is electrically isolated




Diagnostics

Description

In the event of three failed opening attempts, Reflex iC60 locks. The LED is red continuously and the handle is in the upper position.

Unlocking Reflex iC60


DANGER

HAZARD OF ELECTRIC SHOCK

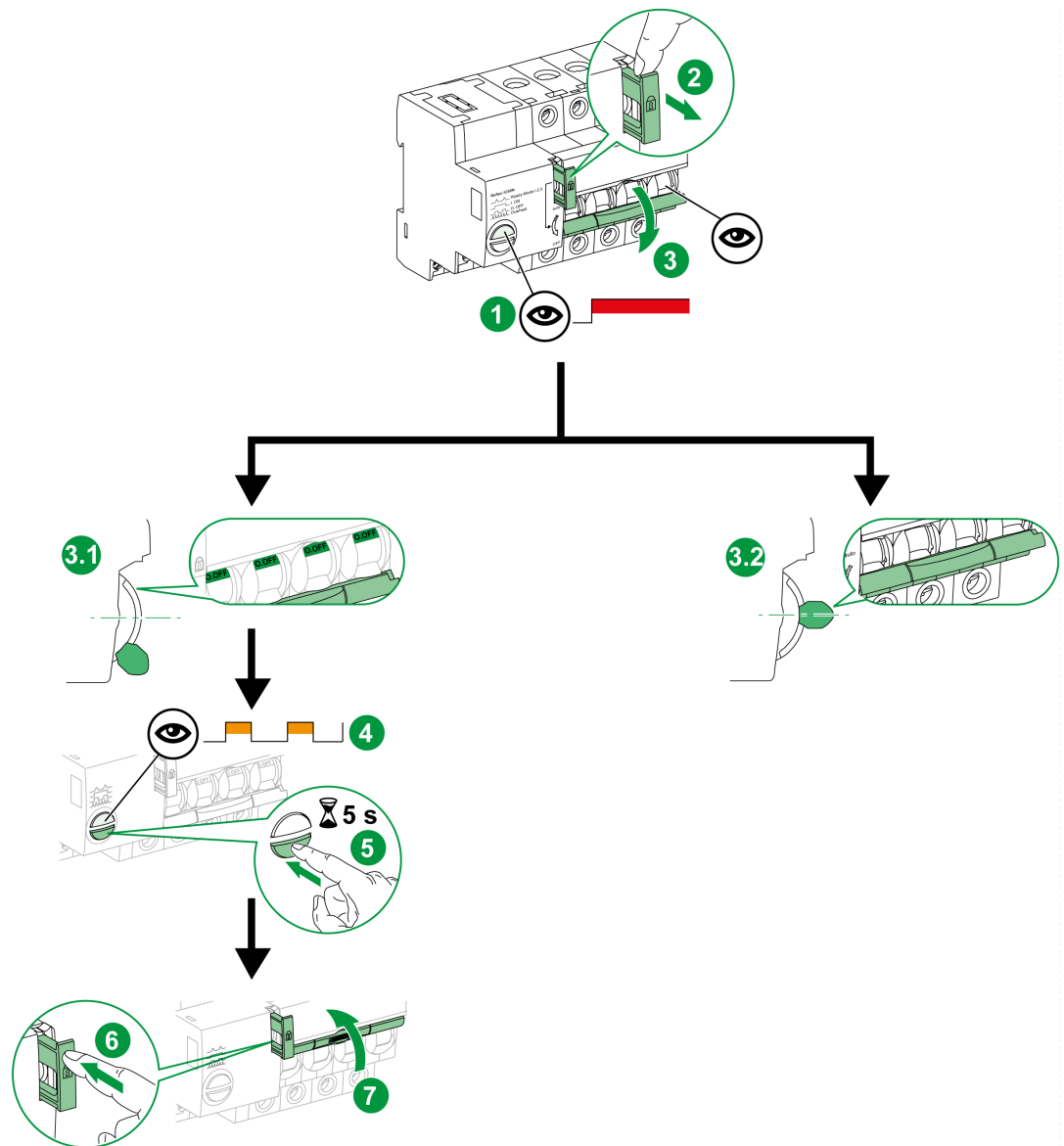
- Only a qualified engineer can work on the electrical installation and on this device.
- Work on the electrical installation and on Reflex iC60 must only be undertaken by one person.
- No-one else must work on the electrical installation during work on Reflex iC60.
- A circuit continuity test must be performed to check the state of the contacts (poles welded or not welded).

Failure to follow these instructions will result in death or serious injury.

A qualified person is one who has skills and knowledge related to the construction, operation and installation of electrical equipment, and has undertaken safety training in how to identify and avoid the hazards involved.

The following procedure describes the actions to be performed to unlock Reflex iC60.

Step	Action
1	Check that the circuit breaker operating state LED is red continuously.
2	Pull out the padlocking device.
3	Flip the handle down: <ul style="list-style-type: none"> ● If the handle switches to the OFF position (circuit breaker open), go to the next step. ● If the handle only opens in the middle, the Reflex iC60 is out of order.
4	Press the pushbutton on the Reflex iC60 circuit breaker for 5 seconds.
5	Check that the circuit breaker operating state LED is flashing orange slowly.
6	Push the padlocking device back in.
7	Place the handle in the upper position ON (circuit breaker closed).



- 3.1** Reflex iC60 locked following three failed opening controls.
3.2 Circuit breaker poles welded: Reflex iC60 out of order.

Chapter 6

Application examples

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Outdoor parking lot lighting	50
Office lighting	51
Workshop lighting	52

Outdoor parking lot lighting

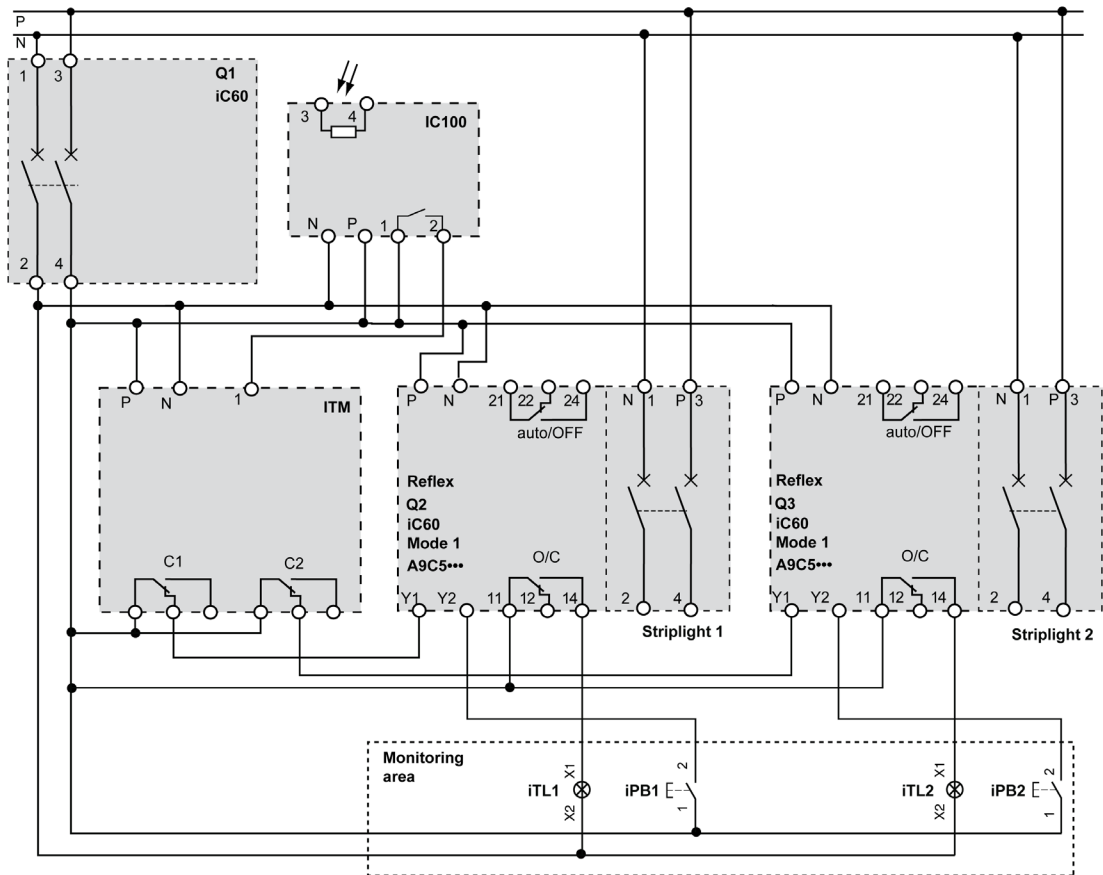
Application example: outdoor parking lot lighting

The aim is to light a parking lot with two power levels:

- Automatically according to the time slots when it is used and the external light level
- Manually using pushbuttons

The proposed solution is as follows:

- The two banks of lights are controlled by two Reflex iC60 circuit breakers without Ti24 interface (A9C5****) set to mode 1.
- A multifunction time switch combined with a light sensitive switch sends opening or closing commands to each circuit breaker via input Y1 according to the time slots corresponding to the periods when the parking lot is used.
- One pushbutton and one control indicator lamp for each bank of lights is used to override (via input Y2) switching on/off of the bank.



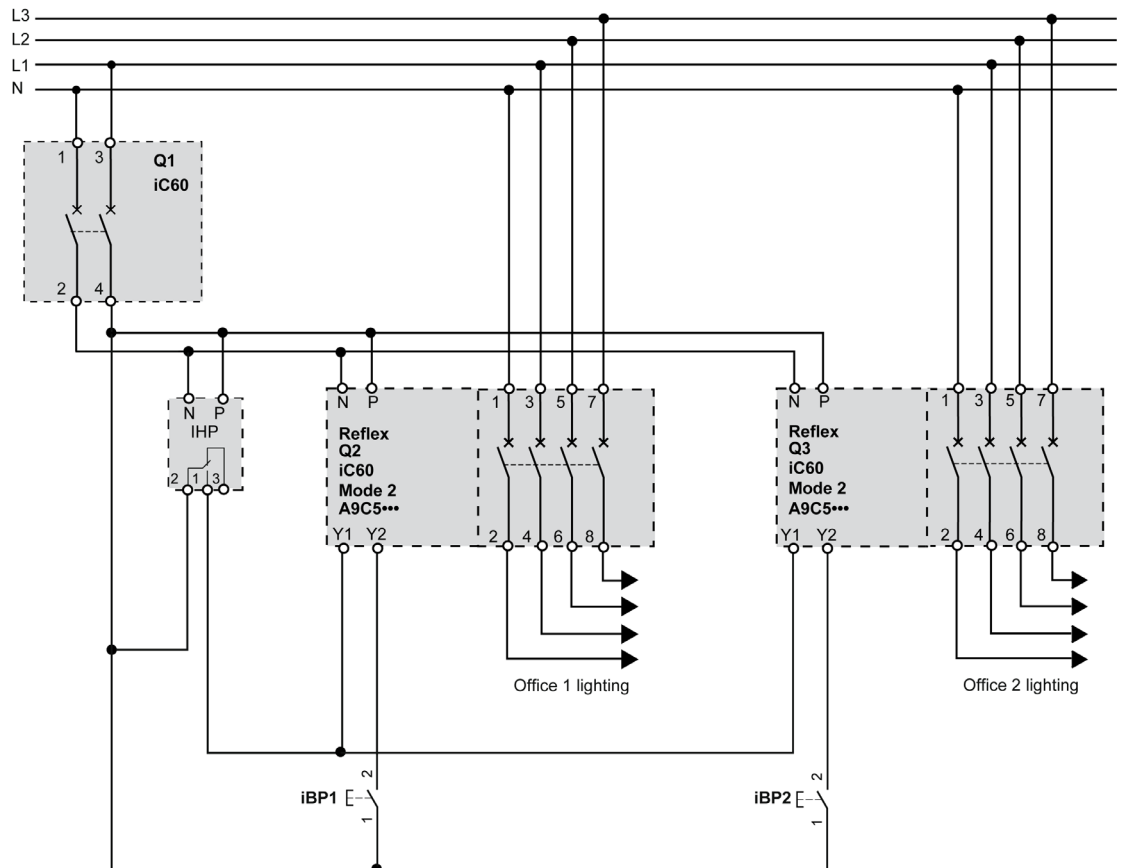
Office lighting

Application example: office lighting

The aim is to light offices with automatic switch-off set according to defined time slots.

The proposed solution is as follows:

- The office lighting is controlled by Reflex iC60 circuit breakers without Ti24 interface (A9C5****) set to mode 2. In this mode, when Y1 is at high state, the circuit breaker is open and the controls on input Y2 are inhibited. When input Y1 is at low state, the circuit breaker is controlled by input Y2.
- Pushbuttons are used to control the office lighting locally via input Y2.
- A weekly programmable timer switch is used to override switching off of the lighting outside office opening times by periodically sending pulses on input Y1.



Workshop lighting

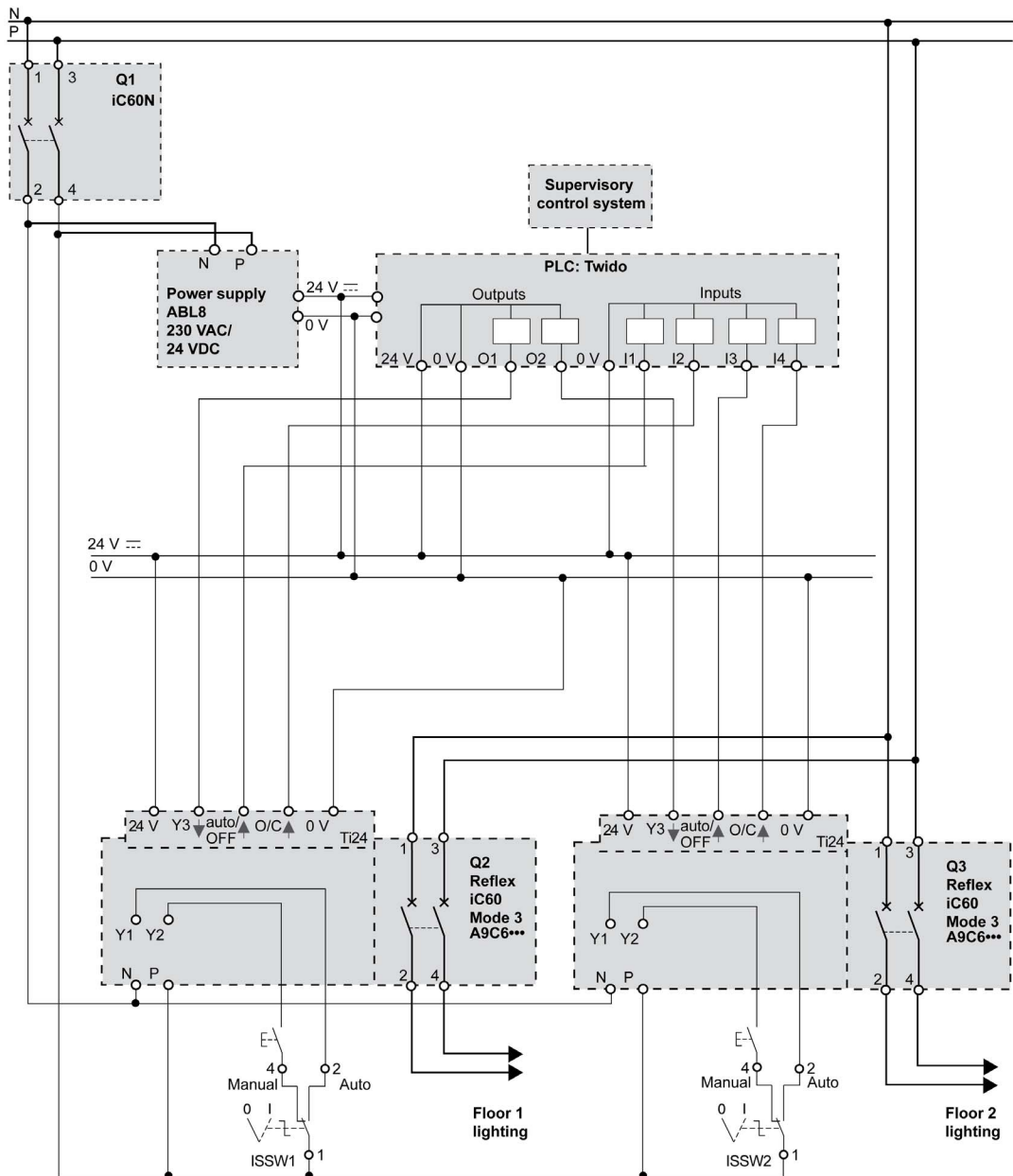
Application example: workshop lighting

The aim is to have:

- Centralized workshop lighting mode by means of the building management system (BMS)
- Local mode in order to work on the system if maintenance is required
- Two levels of lighting power.

The proposed solution is as follows:

- Two banks of lights in the workshop are controlled by Reflex iC60 circuit breakers connected to a PLC via the Ti24 interface and set to mode 3. In this mode, input Y1 is used to choose between local mode (Y1 = 0) and centralized mode (Y1 = 1). In local mode, the circuit breaker is controlled by pulses on input Y2. In centralized mode, the circuit breaker is controlled by rising and falling edges on input Y3.
- In centralized mode, the circuit breakers controlling the lighting are controlled by the PLC via input Y3.
- In local mode, the circuit breakers controlling the lighting are controlled by pushbuttons via input Y2.





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As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

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