

# CAT-H

## Circuit Breaker Analyzer & Timer



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**amperis**

# CAT-H

## Circuit Breaker Analyzer & Timer

- Compact and ergonomic design – only 1,6 kg (3.5 lbs)
- Simple and easy to operate
- Battery operation for up to 8 hours
- Timing and coil current measurement
- Coil control (built-in) for OPEN and CLOSE coil
- Graphical results for quick interpretation
- Touch screen color display 145 mm (5.7 in)
- On-site analysis of test results (overlay up to 4 records in graphical form)



## Description

Handheld Circuit Breaker Analyzer & Timer CAT-H is a digital instrument for circuit breakers condition assessment. CAT-H records graphs of both, open and close coil currents, timing of main arcing contacts, DC substation battery voltage. The timing channels record closing and opening of the main contacts and can also measure the resistance value of the pre-insertion resistors (if present in the circuit breaker).

CAT-H provides an easy selection of different operating modes:

- Open (O)
- Close (C)
- Trip free (CO)
- Reclose (O-C)
- Close-Open (C-O)
- Open-Close-Open (O-C-O)

Multiple operations, such as Open-Close and Open-Close-Open, can be initiated by using a predefined delay time or by sensing a breaker's contact position.

The circuit breaker operation can be initiated in different ways (for instance from a control room, by a local switch or externally by a testing device) depending on a testing condition. The several time measurement triggers are available to record a measurement in a various testing condition:

- Coil control channel
- DC current clamp channel
- DC voltage channel

CAT-H is a powerful diagnostic tool for recording and analyzing:

- Main arcing contacts operation
- Trip/Close coils operation
- Auxiliary contact operation
- DC supply voltage
- Integrity of control circuit wiring

CAT-H displays numerical and graphical results (it can overlay up to 4 records in graphical form). This enables quick onsite analysis of potential defects by comparing the obtained test results.

## Features



**1 - Coil supply input** Voltage supply input for coil control.

**2 - Coil control outputs** Used for operating the circuit breaker's OPEN and CLOSE coil.

**3 - DC current clamp input** Used for a DC coil current recording and measurement.

**4 - DC voltage channel input** Used for a voltage measurement of an analog signal.

**5 - Main contacts input for offline measurement** Used for timing of the main and pre-insertion resistor contacts, and for the resistance measurement of the pre-insertion resistors.

**6 - Touchscreen display** Touchscreen color display 5.7 in

**7 - Soft keys** Used for selecting preferred (test) settings (options/menus) as an alternative to touchscreen.

**8 - Alphanumeric keypad** Used for entering breaker data, test data and control functions.

**9 - Power ON/OFF indicator** Indicates if the instrument is turned ON/OFF..

**10 - READY button** Prepares the instrument for the start of the test.

**11 - Power ON/OFF button** Used for turning ON/OFF the instrument turning.

**12 - DC power supply** 12 V DC, 3 A DC adapter 85-264 V AC (47-63 Hz) / 12 V DC

**13 - Flash drive** Used for a direct download of test results on a USB memory stick.

**14 - PC communication** USB interface for PC.

## Application

The list of the instrument applications includes:

- Timing measurement of up to 3 main contacts (1 break per phase) including pre-insertion resistors (if present in the circuit breaker) and auxiliary contact.
- Resistance measurement of the pre-insertion resistors (if present in the circuit breaker).
- Main contacts bounce time measurement.
- Pre-trigger time measurement.
- Evaluation of synchronization between the circuit breaker poles.
- A measurement and graphical display of the coil currents.
- Coil control (built-in) for actuation of circuit breaker's OPEN and CLOSE coil.
- Evaluating the state of the substation's battery (or other types of analog signals that may be relevant) by presenting the voltage value numerically and graphically.

## Timing Measurement

Timing measurement of the mechanical operations is one of the most important tests to determine real condition of the circuit breaker. Timing measurement tests fulfill all the requirements stipulated in IEC 62271-100 and ANSI C37.09.

In three-phase systems, not only the contacts in a single pole have to operate simultaneously, but all poles must also operate at the same time. All contacts must be synchronized, within a certain tolerance limit.

Synchronization between the circuit breaker poles during opening shall not exceed 1/6 of the rated frequency cycle (3,33 ms at 50 Hz; 2,78 ms at 60 Hz) and during closing shall not exceed 1/4 of the rated frequency cycle, as well (5,0 ms at 50 Hz; 4,17 ms at 60 Hz).

Simultaneous measurements within a single phase are important in situations where a number of contacts are connected in series.

The CAT-H can be used for measurement of the main arcing contact operating times when the circuit breaker is isolated from the power grid or is being tested at another location such as the manufacturer's premises or a maintenance workshop. When making test connections circuit breaker needs to be disconnected or separated

from its circuit on both sides of the breaker in accordance with the national safety regulations. The circuit breaker needs to be properly grounded to a protective ground.

Auxiliary contacts are mechanically driven by the operating mechanism and are used for control and indication of the main contacts state. There are no general requirements related to timing measurement of auxiliary contacts, described in IEC® and ANSI® standards. However, in order to assess conditions of high-voltage circuit breakers, it is important to check their operation.

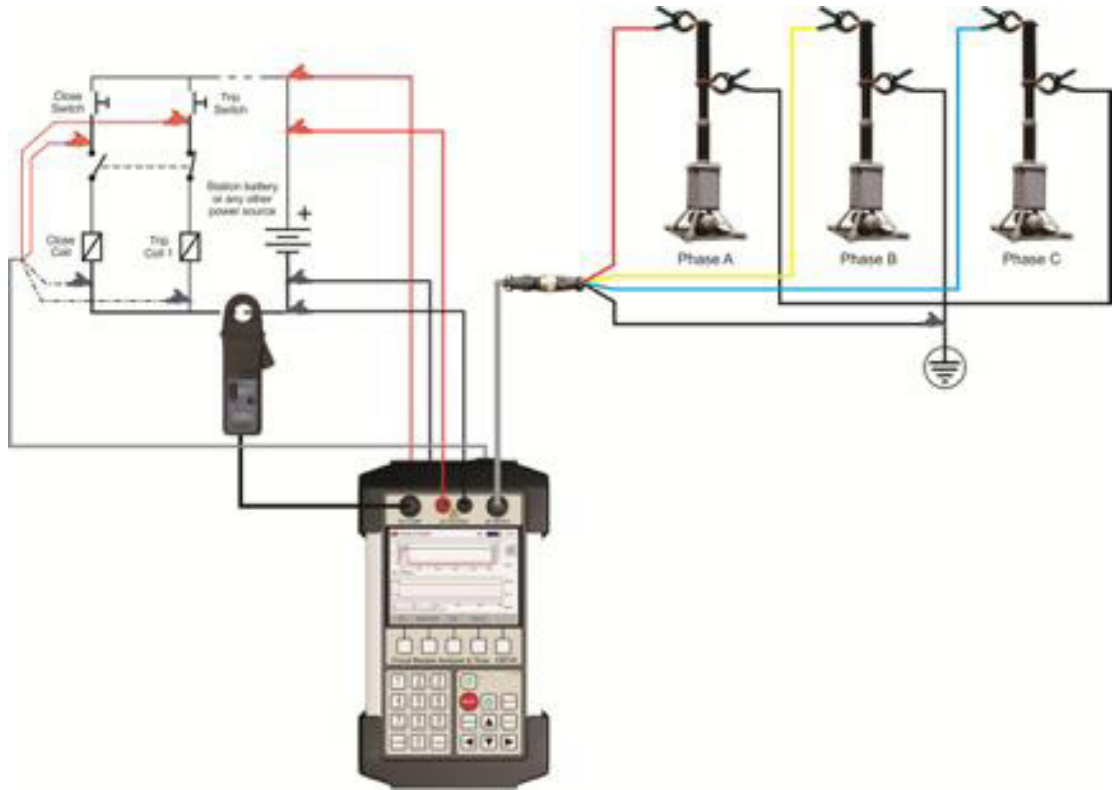


Figure 1. CAT-H connection to live tank circuit breaker with one breaking element per phase

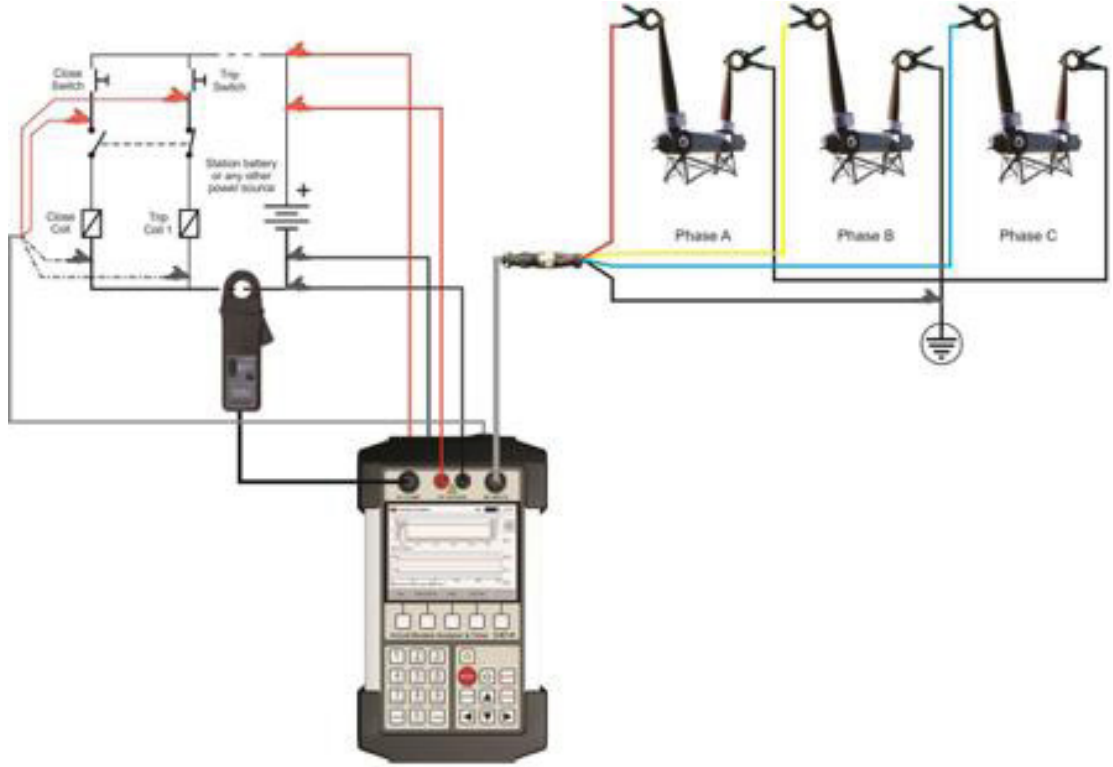


Figure 2. CAT-H connection to dead tank circuit breaker with one breaking element per phase

## Coil current measurement

La norma IEC 62271-100 establece que es deseable registrar la forma de onda de las corrientes de la bobina, ya que proporciona información sobre el estado de las bobinas (por ejemplo, aumento de la fricción de los émbolos, aislamiento quemado, cortocircuito en parte del devanado), la cerradura de desbloqueo del mecanismo de accionamiento (por ejemplo, aumento de la fricción) y el mecanismo de accionamiento (por ejemplo, si se produce una reducción de la velocidad del mecanismo de accionamiento que puede observarse en función del tiempo de apertura de los contactos auxiliares).

Cuando se inicia el comando de apertura o cierre, la bobina se energiza (punto 1) y la corriente aumenta haciendo que un campo magnético aplique una fuerza sobre el émbolo de hierro. Cuando la fuerza sobre el émbolo excede la fuerza de retención, el émbolo comienza a moverse (punto 2). El movimiento del émbolo de hierro induce un EMF en la bobina, reduciendo efectivamente la corriente.

La masa combinada del émbolo y del pestillo sigue moviéndose a una velocidad reducida, lo que provoca una nueva reducción de la corriente de la bobina (puntos 2 a 3).

hasta que llegue a un tope y lo lleve a un punto de reposo (punto 3). Si los valores actuales en los puntos 2 y 3 son más altos que los especificados y el tiempo en el punto 3 es más largo que el especificado, puede indicar una fricción del émbolo y el pestillo. Con el émbolo en reposo, la corriente aumenta hasta el nivel de saturación (corriente continua proporcional a la resistencia de la bobina, punto 4). Si el valor de corriente del punto 4 al punto 5 se desvía de lo específico, puede indicar un aislamiento quemado o un cortocircuito en parte del devanado de la bobina. Mientras tanto, el pestillo desbloquea el mecanismo de operación, liberando la energía almacenada para abrir los contactos del interruptor principal. Normalmente, después de un breve retardo, los contactos auxiliares se abren, desconectando la bobina de apertura de la tensión de control (punto 5). A medida que la bobina se desenergiza, la corriente cae rápidamente a cero de acuerdo con la inductancia de la bobina (punto 6). Un tiempo superior al especificado en los puntos 5 y 6 puede indicar un mal funcionamiento del contacto auxiliar o una energía de accionamiento insuficiente del mando.

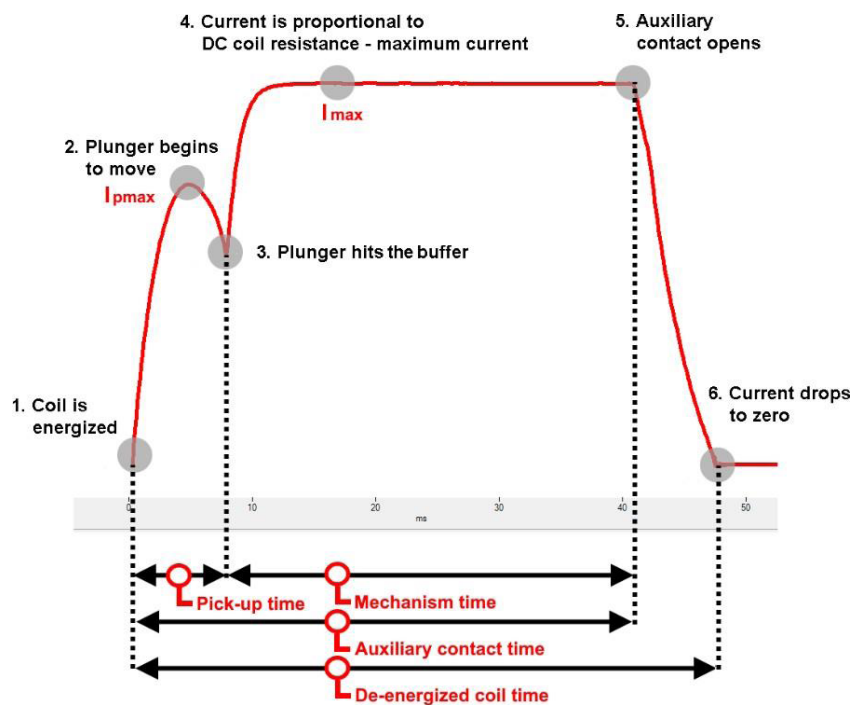


Figure 3. Coil current specific points and measurement parameters

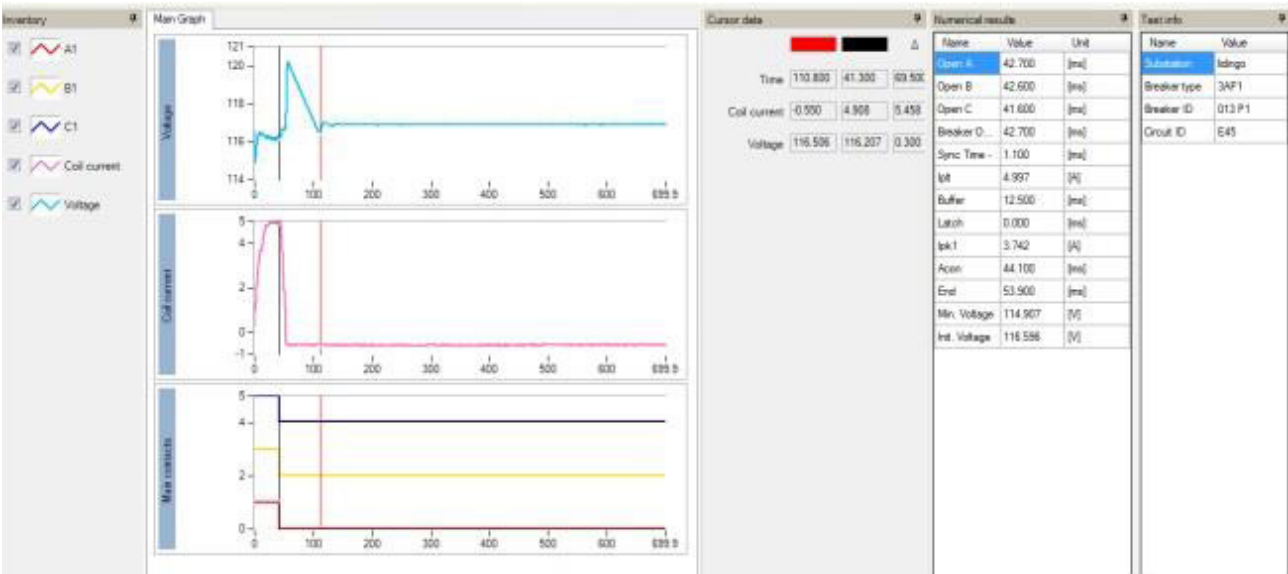
# Software Amperis-Win

Amperis-Win software provides acquisition and analysis of the test results. Graphical presentation of a variety of measurements and timing test results uses cursors and powerful zoom functions for detailed analysis. Colors, grids, scales and positioning of the test data are all controlled by the user.

Amperis-Win supports an automatic unit conversion (e.g. cycles to seconds or mm to inches). The test records can be exported in .cath file format for further analysis.

- Downloading the test results from the
- CAT-H to PC

- Acquisition and analysis of the test results
- The test results can be viewed, edited, saved, printed and exported
- Viewing and overlaying several graphs, for an easy test result comparison
- Selecting the measurement points and intervals using the two cursors
- Zoom and pan graph feature
- Customized configuration of the test result graphs



## Technical data

### Main contact inputs

- Number of contact inputs:  
3 (3 x 1), 1 per phase
  - Each channel detects Main contacts
    - Closed  $\leq 10 \Omega$ ,
    - Resistor contacts range  $10 \Omega$  to  $5 \text{ k}\Omega$
    - Open  $\geq 5 \text{ k}\Omega$
- Open circuit voltage: 20 V DC  $\pm 20\%$   
Short circuit current 50 mA

### Time measurement

Time measurement resolution:

- 0,05 ms to 10 ms depending on test duration (sampling rate up to 20 kHz)

Time accuracy: 0,05% of the reading  $\pm$  resolution

### Breaker operation

- Close (C)
- Open (O)
- Close-Trip (C-O)
- Trip-Close (O-C)
- Trip-Close-Trip (O-C-O)

### DC Current Clamps

- Nominal current: 300 ARMS or 450 A DCPK
- Measuring ranges: 30/300 A
- Frequency range: DC to 20 kHz (-3 dB)

### DC Voltage Measurement

- Range:  $\pm 300 \text{ V}$
- Typical accuracy:  $\pm 0,5\% \text{ RDG} \pm 0,5\% \text{ FS}$
- Guaranteed accuracy:  $\pm 1\% \text{ RDG} \pm 1\% \text{ FS}$

### Coil driver

- Number of channels: 2 (Trip and Close coil)
- Driver characteristics: 300 V DC max, 35 A DC max
- Electronic drivers provide superior timing control
- Overcurrent and overvoltage protection
- Coil supply input: 300 V DC max, 35 A DC max

### Current measurement

- Current measurement for Trip and Close coil, 2 channels, Hall-Effect sensor
- Range  $\pm 35 \text{ A DC}$  to 5 kHz
- Accuracy  $\pm (0,5\% \text{ rdg} + 0,1\% \text{ FS})$

- Graphic presentation: currents waveform is displayed with a resolution of 0,1 ms

### Handset and inline power supply

- 12 V DC, 3 A
- Input: 90 - 264 V AC, 50/60 Hz

### Internal battery supply

- 2 x 3,7 V, 2900 mAh rechargeable Li-ion battery
- 8 hours under normal usage

### Display

- Touch screen color display 145 mm (5.7 in)

### Applicable standards

- Safety:  
Low Voltage Directive: Directive 2014/35/EU (CE conform)  
Applicable standards, for a class I instrument, pollution degree 2, Installation category II: IEC EN 61010-1
- Electromagnetic Compatibility:  
Directive 2014/30/EU (CE conform)  
Applicable standard: EN 61326-1
- CAN/CSA-C22.2 No. 61010-1

### Environmental conditions

- Operating temperature:  
 $-10 \text{ }^\circ\text{C} - +55 \text{ }^\circ\text{C} / 14 \text{ }^\circ\text{F} - +131 \text{ }^\circ\text{F}$
- Storage & transportation:  
 $40 \text{ }^\circ\text{C} - +70 \text{ }^\circ\text{C} / -40 \text{ }^\circ\text{F} - +158 \text{ }^\circ\text{F}$
- Humidity 5% - 95% relative humidity, non condensing

### Dimensions and weight

- Dimensions (L x W x H):  
310 x 170 x 58 mm / 12.21 x 6.69 x 2.28 in
- Weight: 1,6 kg / 3.5 lbs

### Warranty

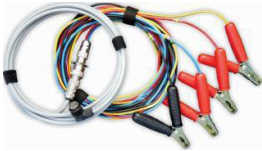
- 3 years

*All specifications herein are valid at ambient temperature of +25 °C and recommended accessories.*

*Specifications are subject to change without notice.*



## Accessories



Main Contact Cables  
8 m (26.3 ft) with alligator  
clamps (A1)\*



Main contacts connection  
3 x 1 m (3.3 ft) and ground  
2 m (6.6 ft) cable with  
alligator clamps (A1)\*



Voltage sense cable set  
2 x 5 m (16.4 ft) 2,5 mm<sup>2</sup>  
(13 AWG) with banana plugs\*



Current clamp 30/300 A power  
supplied from the instrument  
with extension 5 m (16.4 ft)\*



Coil control cable set 5 m  
(16.4 ft) with banana plugs\*



Coil supply cable set 2 x 5  
m (16.4 ft) 2,5 mm<sup>2</sup> 13 AWG  
with banana plugs\*



Test probe with grip  
jaws (red, black)



Dolphin clip (red, black)



Plastic transport case for CAT-H



Cable bag



Power supply adapter



Resistive touch pen

*\*The cables are also available in several lengths and terminations.  
Please contact Amperis for more information.*

## Order info

Instrumento con accesorios incluidos	Article No
Analizador manual de interruptores y temporizadores CAT-H con software Amperis-Win que incluye memoria USB y cable mini USB, lápiz táctil resistivo y maletín de transporte de plástico	CATH000-N-00
Adaptador de alimentación	

Recommended accessories	Article No
Main contacts cable set 8 m (26.3 ft) with alligator clamps (A1)	CMP-08-SETA1
Main contacts connection 3 x 1 m (3.3 ft) and ground 2 m (6.6 ft) cable with alligator clamps (A1)	MC-CG-0302A1
Coil control cable 5 m (16.4 ft) with banana plugs	CO-05-00C5B1
Test probe with grip jaws (black) (x 2)	TESTPR-GJ-B0
Test probe with grip jaws (red) (x 2)	TESTPR-GJ-R0
Coil supply cable set 2 x 5 m 2,5 mm <sup>2</sup> (16.4 ft, 13 AWG) with banana plugs	C2-05-02BPBP
Dolphin clip (black)	DOLPIN-CL-B0
Dolphin clip (red)	DOLPIN-CL-R0
Cable bag	CABLE-BAG-00

Recommended accessories	Article No
Main contacts cable set 10 m (32.8 ft) with alligator clamps (A1)	CMP-10-SETA1
Main contacts cable set 8 m (26.3 ft) with alligator clamps (A2)	CMP-08-SETA2
Main contacts cable set 10 m (32.8 ft) with alligator clamps (A2)	CMP-10-SETA2
Main contacts cable set 8 m (26.3 ft) with SCT clamps	CMP-08-SETST
Main contacts cable set 10 m (32.8 ft) with SCT clamps	CMP-10-SETST
Current clamp 30/300 A power supplied from the instrument with extension 5 m (16.4 ft)	CACL-0300-09
Voltage sense cable set 2 x 2 m 2,5 mm <sup>2</sup> (6.6 ft, 13 AWG) with banana plugs	S2-02-02BPBP
Voltage sense cable set 2 x 5 m (16.4 ft) 2,5 mm <sup>2</sup> (13 AWG) with banana plugs	S2-05-02BPBP
Voltage sense cable set 2 x 10 m 2,5 mm <sup>2</sup> (32.8 ft, 13 AWG) with banana plugs	S2-10-02BPBP
Coil control cable 10 m (32.8 ft) with banana plugs	CO-10-00C5B1
Coil supply cable set 2 x 10 m 2,5 mm <sup>2</sup> (32.8 ft, 13 AWG) with banana plugs	C2-10-02BPBP
Test probe with split test clamps (black)	TESTPR-SC-B0
Test probe with split test clamps (red)	TESTPR-SC-R0
Resistive touch pen	RSTCH-PEN-00
Plastic transport case for CAT-H	HARD-CASE-HH
Power supply adapter EU 3 A	PWR-ADP3A-EU

Power supply adapter NA 3 A	PWR-ADP3A-NA
Power supply adapter UK 3 A	PWR-ADP3A-UK
Power supply adapter AU 3 A	PWR-ADP3A-AU

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PROYECTO COFINANCIADO POR EL IGAPE, XUNTA DE GALICIA Y FONDO EUROPEO DE DESARROLLO REGIONAL DEL PROGRAMA OPERATIVO 2014-2020



Xacobeo 2021

