FXD
Recloser Control
Smart and reliable microprocessor-based control for everyday protection

E·T·N
Powering Business Worldwide

COOPER

FXD
Microprocessor-Based Recloser Control

About The Product

The FXD recloser control is the latest in a series of fully integrated controls developed by Cooper Power Systems, ready for the Smart Grid. It is designed as a smart and reliable solution to meet your requirements for ease-of-use, simplicity, and future upgradeability. Additional functions are provided as options depending on your requirements.

The control is housed in a weatherproof cabinet to ensure reliability. In addition, it can be housed separately from the recloser as they are connected via cable.

The control is easy to operate as it adopts a standard look and feel with a universal platform that can be used for almost any protective application. This means that field engineers need only learn *ONE* standard operating system and application to maintain *MULTIPLE* protective applications.

Why Cooper Power Systems

Cooper Power Systems, is a subsidiary of Cooper Industries plc (NYSE: CBE), and a global manufacturer of world-class power delivery and reliability solutions for the utility, commercial, and industrial markets. Cooper Power Systems is a leading provider of innovative Smart Grid technologies that optimize electrical grid performance. These solutions include Advanced Metering Infrastructure (AMI), Demand Response (DR), Smart Sensors, Power Systems Engineering Software and Services, Substation Automation, and Feeder Automation. The company is also a leading provider of software, communications and integration solutions that enable customers to increase productivity, improve system reliability, and reduce costs. For more information, please visit www.cooperpower.com.

Table Of Contents

FXD Recloser Control

Contents

Product Features

Smart and reliable, long-term investment.

The FXD recloser control is the latest design in the series of fully integrated controls developed by Cooper Power Systems, ready for the Smart Grid.

- A smart and reliable solution designed for easy maintenance and future upgradeability.

- Offers flexible phase and ground overcurrent protection for the main feeder, and provides power quality monitoring and metering.

- Contains modular components (control module, power supply module, cabinet, heater, and MCCB) that are easy to maintain and service.

- The control panel of the recloser is interactive, with programmable soft keys and large interface push-buttons to allow for single push activation of commonly used control functions. Its LED indicators show the current status of the recloser.

- The control is password protected and housed in a weatherproof cabinet that can be padlocked.
  With cables connections to the recloser, the control can also be housed separately from the recloser.

- Requires an external power source of 50Hz or 60Hz of 120V AC or 240V AC (two-wire or three wire) for operation. It is also equipped with an 8 Amp-Hour / 18 Amp-Hour lead acid battery for operation upon loss of AC power, supporting up to 120 hours in standby mode. This battery can also be used for on-site commissioning when no AC power is available.

- Designed to comply with IP65 protection for electronics.

- Designed to operate under ambient temperature range from -40°C to 65°C.

Control Design

The most economical option for basic control applications.

Weatherproof Cabinet

- The control is housed in a weatherproof cabinet where pad-lock(s) can be used to prevent unauthorized access.

- Since the control is connected via cables to the recloser, it can be located separately from the recloser, where only authorized personnel can gain access to the control.
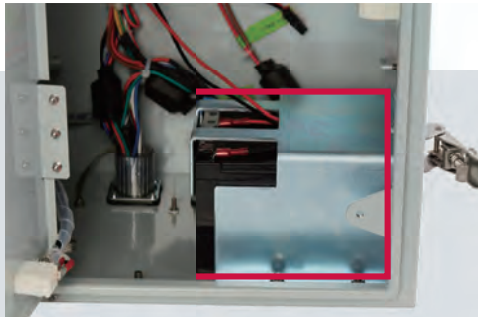
Standby Battery

- The control is equipped with an 8 Amp-Hour / 18 Amp-Hour 24V DC lead acid battery for backup control operation in the event when there is a loss of primary power supply.

- This battery can support up to 120 hours on standby mode.

- If the primary power supply is not restored within the allowable discharge time of the battery, the control will shut down automatically.

- Upon restoration of primary power supply, the control may be restored to full operation within three seconds.

- When operating under battery, the battery indicator LED light is illuminated.

- Battery power can also be used for short-time commissioning or testing when primary power supply is unavailable.

Control Design

The most economical option for basic control applications.

Control Circuit Protection

- A Molded Case Circuit Breaker (MCCB) is used to turn on the control. It also protects the control from overcurrent damage due to maloperations.

Power Supply Module

- The power supply module is sealed in an aluminium box.

- Provides additional security to the operators when working inside the cabinet, preventing electrical hazard.

- Protects the circuit from accidental damage by work activities inside the cabinet.


Intuitive Human Machine Interface (HMI)

- The control has an intuitive Human Machine Interface (HMI) front panel including a LCD module, recloser's status LED indicators, and large function keys.

- The keypad control is used to control the following status:
  - Control programming
  - Ground Trip Normal / Block
  - Non-Reclose Normal / Off
  - Sensitive Earth Fault (SEF) Normal / Block
  - Supervisory Normal / Off

Control Design

The most economical option for basic control applications.
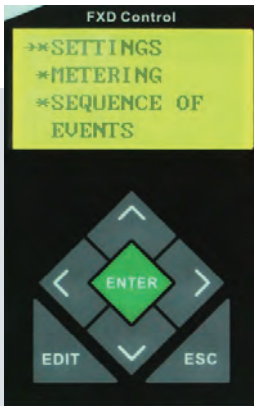
Simple LCD Module

- The control has a 4-line LCD with large characters for easy reading, with backlighting option.

- The contrast is field-adjustable to allow for various mounting heights and applications.

- The backlight will shut off automatically after 15 minutes of inactivity.

Large Function Keys

The large function keys allows quick access to frequently used operations:

- *TRIP (LOCKOUT)*: Manually trip (lockout) the recloser. When pressed, it will opens the recloser and locks out the control.

- *CLOSE*: Manually close the control, i.e., returns the control to the initial or home sequence position, closing the recloser. The control is now ready for the start of a new trip / close sequence.

- *HOT LINE TAG ON/OFF*: This is provided for live-line work applications. When activated, all closing attempts from the control are disabled, and shifts protection to one trip-to-lockout on the composite curve of the Hot Line Tag definite time and the TCC1 curve (whichever is faster). Hot Line Tag takes precedence over Cold Load Pickup, Non-Reclosing, and Fast Trips Disabled.

- Refer to the section (Instant Status Notifications) for more details on *GND TRIP BLOCKED, NON RECLOSE, SUPERVISORY OFF and SGF/SEF BLOCKED*.

- *PRGORAMMABLE LED INDICATORS:* Optional indicators. Customizable LEDs that are used with functions programmed through FXD Insight View. The indicators do not have active default values.

Large Function Keys

- In addition to physical access security, the FXD recloser control is equipped with programmable security codes to limit control programming to authorized personnel.

Control Design

The most economical option for basic control applications.
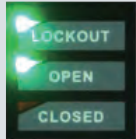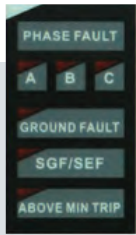
Instant Status Notifications

The status LED indicators provide instant notification on the control and recloser status. The respective LED indicators will illuminate for the following conditions:

- *Phase Fault A, B, C, Ground Fault, Sensitive Ground Fault (SGF) / Sensitive Earth Fault (SEF)*: The control issues an overcurrent trip signal where the respective phase current or the ground current exceeds the minimum pickup value.

- *ABOVE MIN. TRIP*: The control detects that current is above the programmed minimum trip value for Bushings 1-2, Bushings 3-4, Bushings 5-6, Ground, or Sensitive Ground.

- *LOCKOUT*: The control is in the lockout state, i.e. a reclosing sequence is not in progress.

- *OPEN*: The recloser is in OPEN position.

- *CLOSED*: The recloser is in CLOSE position.

- *ALARM*: A line fault has occurred.

- *CONTROL OK*: The control has passed self diagnostics and is capable of normal operation.

- *AC POWER*: The control is using AC power supply for its operations.

- *BATTERY*: The battery power health status.

- *GND TRIP BLOCKED*: Group Trip Blocked has been activated from the front panel keypad, supervisory control, or programming.

- *NON-RECLOSE*: Non-reclose operation has been activated via the front panel keypad, supervisory control, or programming.

- *SUPERVISORY OFF*: Supervisory commands are blocked when activated via the operator panel. Operational data and metering information are available.

- *SGF/SEF BLOCKED*: Sensitive Ground Fault (SGF) / Sensitive Earth Fault (SEF) Blocked has been activated via the front panel keypad, supervisory control, or programming.

Control Design

The most economical option for basic control applications.

Programmable Control Functions

The front panel of the FXD control can be used to program and query the control, as well as display metering and alarm information. The features supported by the software include:

- *IEC Time Current Curves* (TCC) are available for user selection. Each TCC is available for phase trip or ground fault trip timing. Both phase and ground TCC can be programmed independently for each trip operation of the programmed number of trip operations to lockout, up to the maximum of four trip operations. Kyle™ recloser curves are available up on request. TCC multiplier, Constant Time Adder, and Minimum Response Time can be changed for any of the TCC.

- After an extended outage, the *Cold Load Pickup* function is used during service restoration. This feature transfers operation from the normal program phase to ground TCCs to a separate programmable TCC for a programmable time of 1 to 60 seconds. It supports up to a maximum of four (4) operations can be programmable.

- *The Reclose Retry* function is used to interrupt the closing signal to the recloser when closing power is lost. The CLOSE signals are issued at regular intervals until closing power is restored. The number of retry attempts and service retry duration can be programmed.

- *High Current Trip* function will bypass the normal TCC and trip the recloser with a programmable constant when the fault current exceeds the programmed minimum trip. It can be configured for any trip operations of the operating sequence.

- *High Current Lockout* function is used to automatically lockout the control when the current exceeds a programmed threshold. The active number of operations-to-lockout is selectable for both phase and ground.

- *Sensitive Ground Fault Trip* provides tripping of the recloser after a programmable, definite time for ground (zero sequence) currents lockout counter. This option is available in both normal ground minimum trip and alternate ground minimum trip settings.

- Phase instantaneous and time overcurrent protection (50P/51P).

- Ground instantaneous and time overcurrent protection (50N/51N).

- Protection setting groups: maximum 4 groups.

- Definite time (constant)-current curve is available for customer selection setting Constant Curve separately for every protection function.

Other Features

- A sequence of event recorder and store the recent 100 events in non-volatile memory. The stored information includes date and time of the event occurrence, the event type, and circuit currents on all three phases and ground (including the fault current for overcurrent trip event).

- The FXD control is equipped with metering capabilities to display Ampere, Volt, KWh, KVAR, KVA, Power Factor, frequency and total harmonic distortion (THD %) of current and voltage.

- FXD control could measure phase current, neutral/ground current at normal mode, phase current, neutral/ground current at fault mode, voltage values of each phase and neutral/ground, power factor of each phase and neutral/ground, real power, reactive power, real power consumption (kWh), reactive power consumption (kVArh) can be measured and recorded over programmable time interval in memory.

- Metering values will be recorded at 30 minute interval and stored in non-volatile memory for the at least 2 months (2880 sets of value).

- The FXD control includes SCADA functionality as an optional feature that includes a Supervisory ON-OFF key and a HOT LINE TAG indicator at the front panel. This SCADA feature will provide operational and status reports.

- Phase and ground directional overcurrent protection (67P/67N).

- Overcurrent Negative Sequence Protection.

- Phase and ground demand current values can be integrated over a programmable time interval of 5, 15, 30, or 60 minutes.

Control Design

The most economical option for basic control applications.

Other Features

- Maximum/minimum phase and ground demand current values.
- Overfrequency/ Underfrequency Protection.
- Overvoltage/ Undervoltage Protection.
- Simulator to test metering and protection function with virtual current and voltage injection.
- An impedance-based fault locator to calculate the distance by impedance calculation.
- Loss of phase protection trips the recloser if phase-earth voltage on one or two phases falls below a defined voltage threshold.
- Smart Phone application for metering, data access, operation and positioning.
- Sync-check capability based on source side ane load side PT to qualify close signal to the mechanism when enabled via the sync check settings.
- Duty cycle monitor to measure and record duty in non-volatile memory.

Input and Output

Current Input	Voltage Input	Control Input	Control Outputs
- Channel: IA, IB, IC, IN - Range: 1A~20A	- Channels: Ua, Ub, Uc, U0	- Standard Channels: 2 - Optional Channels: Up to 8	- Standard Channel: 2 - Optional Channel: Up to 8

Communications

Communication Port
- Engineer port: RS232
- Communication port: RS232, RJ45, MT-RJ

Communication Protocol
- DNP 3.0
- MODBUS
- IEC 60870-5-101
- IEC 60870-5-104
- IEC61850

Communication Module
- GPRS Module
- SMS Module
- Fiber Module
- 61850 Module
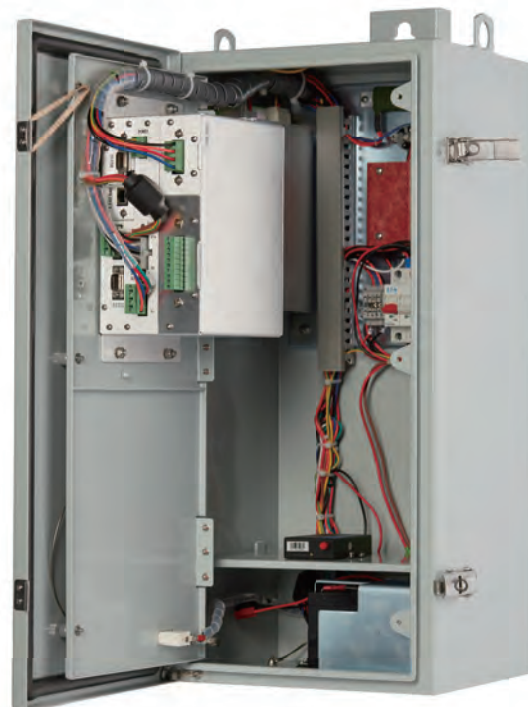
Overall Dimensions

Pole-Mounted, Microprocessor-based FXD Recloser Control

Unit: mm

Optional

Ø17 Mounting Holes(2)

Ø17 Mounting Holes(2)

298.5
270.0
565.0
520.0
152.5
305.0
335

300
270
765
720
87
79
152.5
305
335

Grounding Terminal
#14 To #4 Stranded

International Standards

The FXD recloser control is designed and tested in accordance with the following standards.

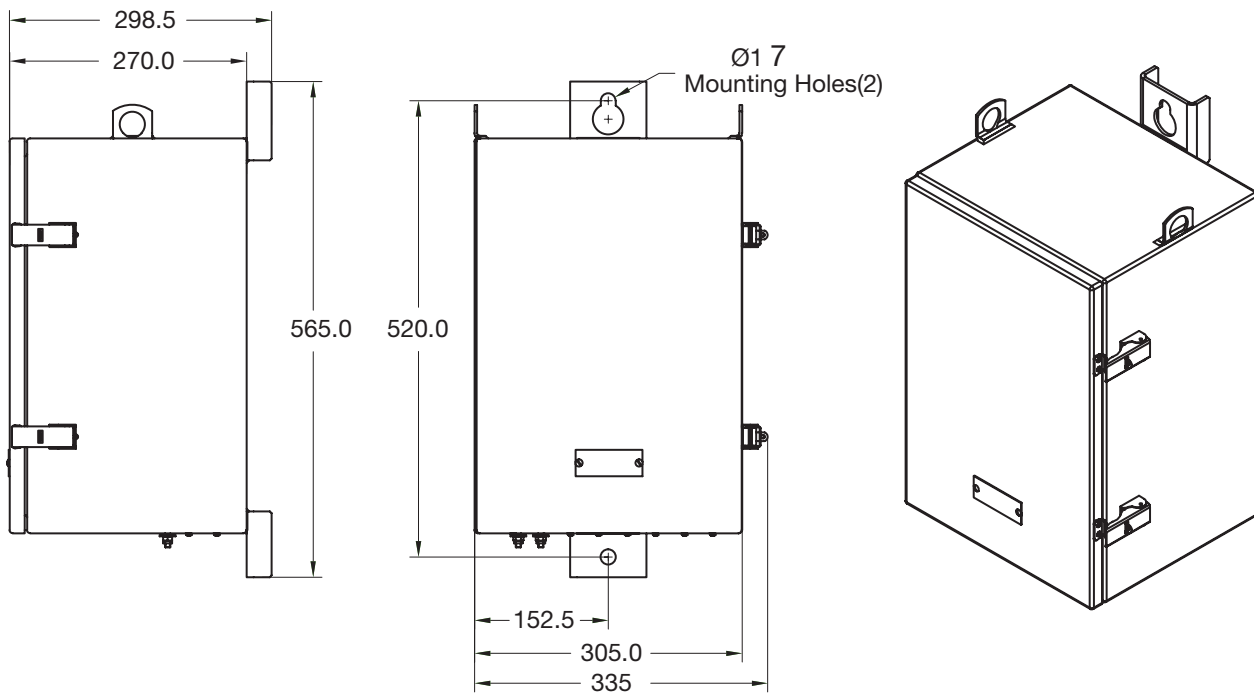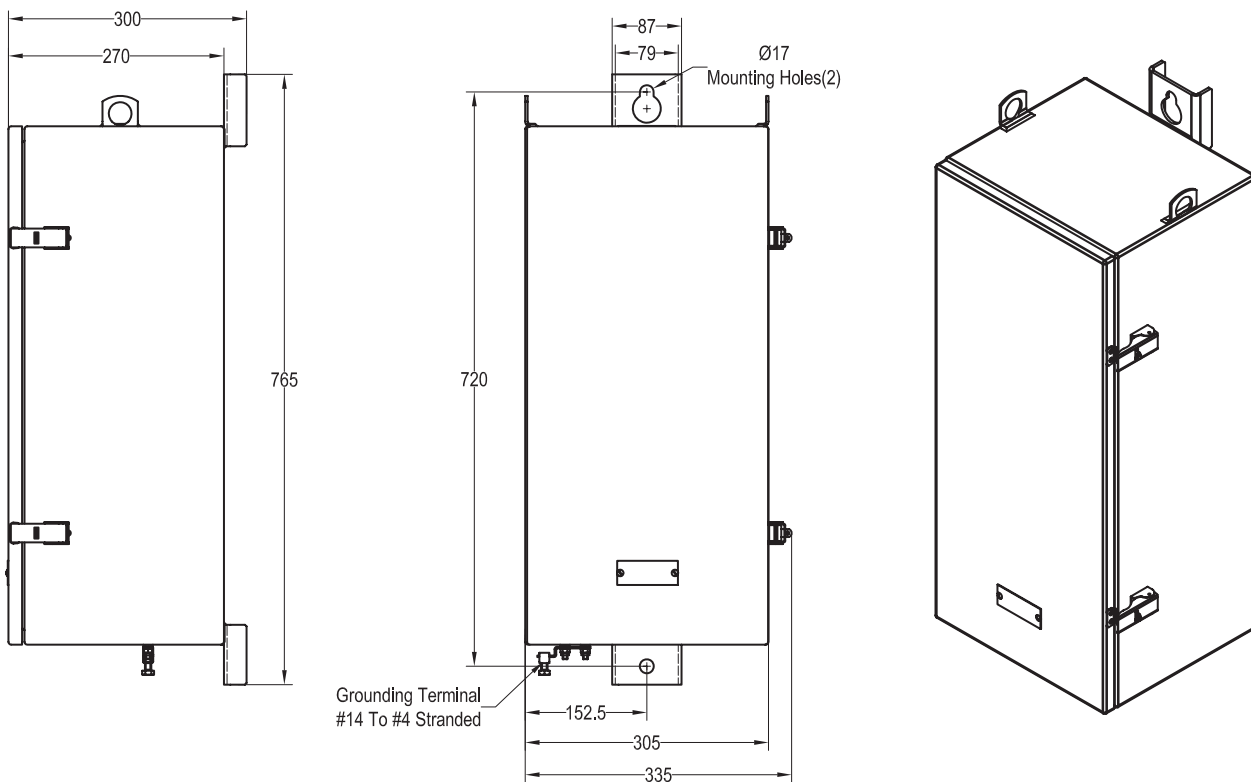| International Standards	Descriptions
ANSI/IEEE C37.60™-2003	American National Standard Requirements for Overhead Padmounted, Dry Vault and Submersible Automation Circuit-Reclosers and Fault Interrupters for Alternating Current Systems.
IEC 255-21-1:1988	Vibration, Shock, Bump, and Seismic Tests in Measuring Relays and Protective Equipment; Vibration tests (sinusoidal), Class 1.
IEC 255-21-2:1988	Vibration, Shock, Bump, and Seismic Tests in Measuring Relays and Protective Equipment; Shock and bump tests, Class 1.
IEC 255-21-3:1993	Vibration, Shock, Bump, and Seismic Tests in Measuring Relays and Protective Equipment; Seismic tests, Class 1 minimum, class 2 preferred.
IEC 60255-5:2000	Insulation Coordination for Measuring Relays and Protection Equipment - Requirements & tests. • Test 6.1.3 - Impulse Voltage Withstand Test. • Test 6.1.4 - Dielectric Test.
IEC 68-2-1:1990	Environmental Tests; Test A: cold, section 4
IEC 68-2-2:1974	Environmental Tests; Test B: dry heat, section 3
EN 55022:1998 (Class A, Industrial)	Information Technology Equipment - Radio disturbance characteristics - Limits & Methods of Measurement; Conducted & radiated emissions
EN 61000-4-2:1995	Electromagnetic Compatibility, Part 4: Test and Measurement Techniques; Section 2: Electrostatic Discharge Test
EN 61000-4-3:1998 (Edition 1.1)	Electromagnetic Compatibility, Part 4: Testing and Measurement Techniques; Section 3: Radiated Radio Frequency Immunity Test.
EN 61000-4-6:2001	Electromagnetic Compatibility, Part 4-6: Testing and Measurement Techniques, Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields; Level 3.
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
EN 61000-4-5:2005	Electromagnetic Compatibility, Part 4: Testing and Measurement Techniques; Section 5: Surge Immunity Test, Class 3 minimum, electrical interconnections running as outdoor cables along with power cables.
EN 61000-4-12:2001	Oscillatory waves immunity test

International Standards

The FXD recloser control is designed and tested in accordance with the following standards.

International Standards	Descriptions
IEC-605-29	IP-Ratings
IEC 68-2-39	Basic Environmental Test Procedures; Damp Heat Cyclic Test
MIL-STD-810F	Wind Blown Rain Test, Method 506.4 procedure 1 - 40 mph wind with a 4 inch/hour rainfall rate.
IEC 1000-4-11:1994	Electromagnetic Compatibility, Part 4-11: Testing and Measurement Techniques, Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests.

FXD, Pole Mount Electronic Recloser Control

ORDERING GUIDE FOR FXD CONTROL

IFXD   **Basic letters for FXD, Pole Mount Recloser Control (NOVAi)**

X   **CONTROL USAGE OPTION**
1 = 19PIN RECEPTACLE FOR NOVAI
2 = 14PIN RECEPTACLE FOR VWVE/VWE

X   **PRIMARY POWER SUPPLY OPTION**
0 = NONE
1 = 2PIN FOR AC220V
2 = 2PIN FOR DC110V
3 = 2PIN FOR DC220V

X   **BACKUP POWER SUPPLY OPTION**
0 = NONE
1 = 8AH/24VDC BATERY
2 = 18AH/24VDC BATTERY

X   **CABINET OPTION**
1 = STANDARD CARBON STEEL
2 = STANDARD STAINLESS STEEL
3 = EXTENDED CARBON STEEL
4 = EXTENDED STAINLESS STEEL

X   **AUX POWER SUPPLY OPTION**
1 = 300W AUX BOARD

X   **VOLTAGE INPUT OPTION**
0 = None
1 = PT*1
2 = 3IVS
3 = 1PT + 3IVS
4 = 3PT + 3IVS

X   **COMM. PORT OPTION**
0 = None
1 = RS232*1
2 = RJ45*1
3 = RS232*1+RJ45*1
4 = RS232*2
5 = RJ45*2

X   **COMM. MODULE OPTION**
0 = NONE
1 = GPRS/GSM MODULE
2 = SMS MODULE
3 = 61850 MODULE

X   **PROTOCOL OPTION**
0 = NONE
1 = DNP 3.0/IEC60870-5-101
2 = DNP 3.0/Modbus/IEC60870-5-101
3 = IEC60870-5-104
4 = DNP3.0/IEC60870-5-101/IEC60870-5-104/Modbus
5 = IEC61850

X   **IO Option**
0 = NONE
1 = 2IN/2OUT
2 = 8IN/4OUT
3 = 9IN/8OUT

X   **LANGUAGE**
1 = ENGLISH
2 = CHINESE

X   **PACKAGE**
1 = PAPER
2 = WOODEN

X   **ETO**
0 = NONE
1 = ETO

IFXD   X   X   X   X   X   X   X   X   X   X   X   X   X   X

Energizing
that demands more.

We deliver:

- **Electrical solutions** that use less energy, improve power reliability and make the places we live and work safer and more comfortable

- **Hydraulic and electrical solutions** that enable machines to deliver more productivity without wasting power

- **Aerospace solutions** that make aircraft lighter, safer and less costly to operate, and help airports operate more efficiently

- **Vehicle drivetrain and powertrain solutions** that deliver more power to cars, trucks and buses, while reducing fuel consumption and emissions

Discover today's Eaton.

Powering business worldwide

As a global diversified power management company, we help customers worldwide manage the power needed for buildings, aircraft, trucks, cars, machinery and businesses.

Eaton's innovative technologies help customers manage electrical, hydraulic and mechanical power more reliably, efficiently, safely and sustainably.

We provide integrated solutions that help make energy, in all its forms, more practical and accessible.

With 2016 sales of $19.7 billion, Eaton has approximately 95,000 employees around the world and sells products in more than 175 countries.

E·AT·N

Powering Business Worldwide

14

Eaton is a power management company with 2016 sales of $19.7 billion. We provide energy-efficient solutions that help our customers effectively manage electrical, hydraulic and mechanical power more efficiently, safely and sustainably. Eaton is dedicated to improving the quality of life and the environment through the use of power management technologies and services. Eaton has approximately 95,000 employees and sells products to customers in more than 175 countries. For more information, visit **www.eaton.com**.

E·T·N
Powering Business Worldwide