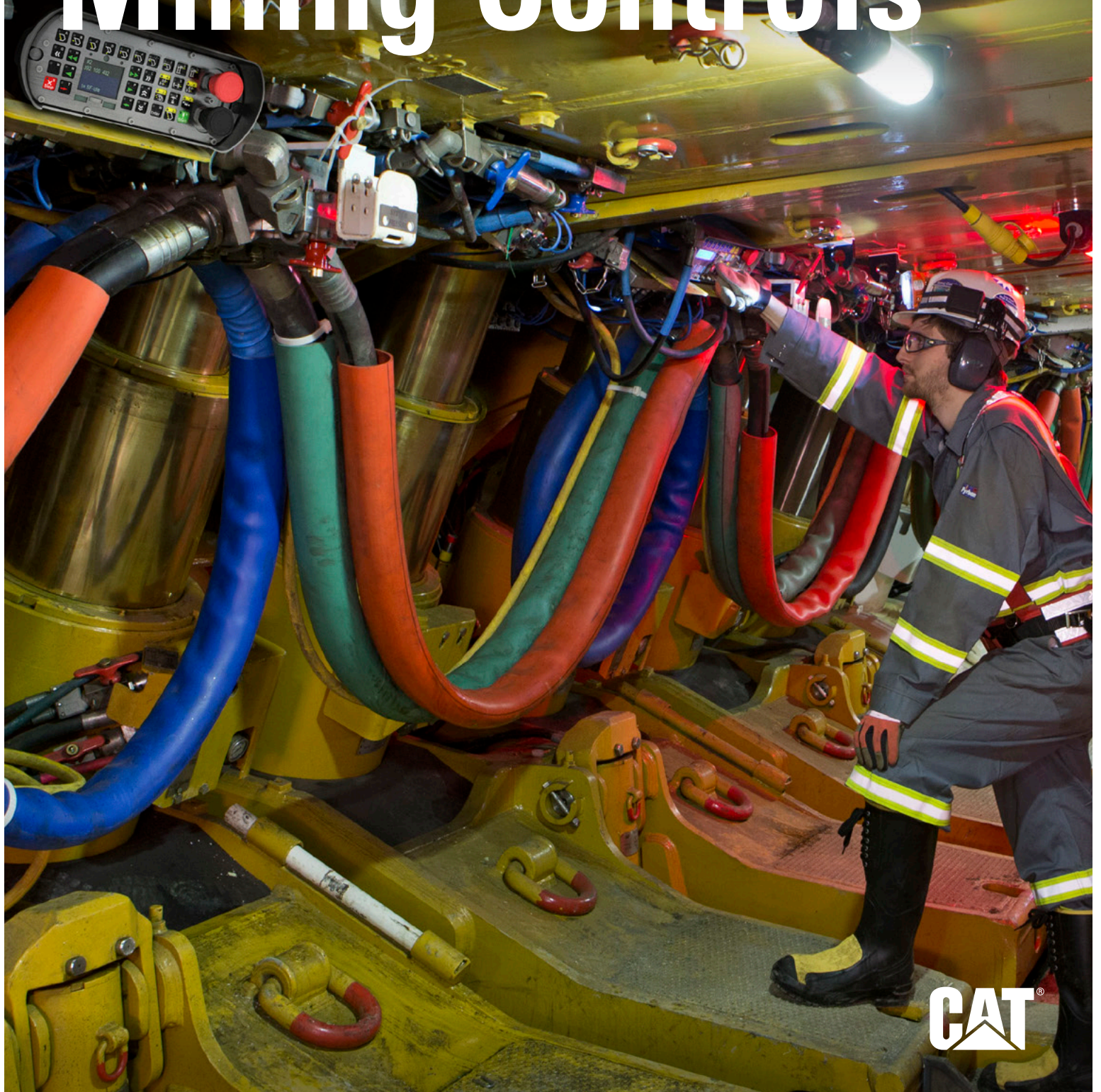


LONGWALL AUTOMATION

# Programmable Mining Controls





# CAT® LONGWALL AUTOMATION

UNPARALLELED CONTROL OF THE ENTIRE SYSTEM



Excellent automation is the basis for the success of a longwall – the quality and reliability of the automation system are key factors in the success of the operation. Caterpillar is the only manufacturer that is able to provide a complete modular family of powerful controllers that integrate fully with Cat® longwall equipment. This means one-stop shopping, no interfacing problems and products customized to your needs.

## FULL RANGE, FULL INTEGRATION

The Cat PMC™ family is the latest generation of controllers designed to meet the control needs of a whole range of applications in underground longwall mining and explosion-hazard areas. State-of-the-art micro controller technology and increased computing power allow a completely new dimension of automation, offering all the functionality you need for enhanced control of drives, roof supports, cutting systems and ancillary equipment. It also offers features for advanced networking, visualization and automation.



*Roof support control unit PMC-R 2.0*

## DESIGN CRITERIA

Cat longwall automation systems are designed to:

- + MAXIMIZE AUTOMATION OF THE WHOLE LONGWALL
- + MAXIMIZE PRODUCTION
- + MAXIMIZE SAFETY
- + OPTIMIZE USE OF EQUIPMENT
- + MINIMIZE COMPONENT OVERLOAD
- + MINIMIZE EXPOSURE OF MINE PERSONNEL TO UNSAFE AND DUST-LADEN AREAS
- + EASE OF USE

## BENEFITS

The integration of the various machines (plow or shearer, AFC, and roof supports) allows optimal tuning of the complete system. This results in numerous benefits for the user, including:

- + FULL UTILIZATION OF PLOW, SHEARER AND AFC CAPACITY
- + PROTECTION OF THE SYSTEM FROM OVERLOAD
- + MINIMIZED CHAIN DOWNTIME, EXTENDED SERVICE LIFE OF DRIVES
- + OPTIMIZATION OF CHAIN TENSION, DEPENDENT ON LOAD, FOR ALL LOAD CONDITIONS
- + MAXIMUM POSSIBLE STARTUP TORQUE FOR HEAVY-LOAD START-UP
- + MACHINE SPEED ADJUSTED TO THE CONVEYOR LOAD, NO OVERLOAD OF SYSTEM
- + TIMELY MOVEMENT OF ROOF SUPPORTS TO AVOID DELAYS
- + OPTIMAL SETTING OF ROOF SUPPORTS WITH OPTIONAL INCREASE IN SET PRESSURE
- + OPTIMAL SPRAYING TO MINIMIZE AIRBORNE DUST
- + CONTROL OF SYSTEM FROM LOW-DUST AREAS
- + PROTECTION OF STEEL COMPONENTS THROUGH MONITORING
- + UNATTENDED PLOW LONGWALLS
- + SIMPLE INSTALLATION AND SETUP OF COMPONENTS
- + SIMPLE MAINTENANCE
- + RELIABLE MINE DUTY SYSTEM
- + USE OF VISUALIZATION FOR MAINTENANCE TASKS AND COMPREHENSIVE DIAGNOSTICS
- + SURFACE MONITORING AND REMOTE OPERATION



*Roof supports*



*Shearer longwall*



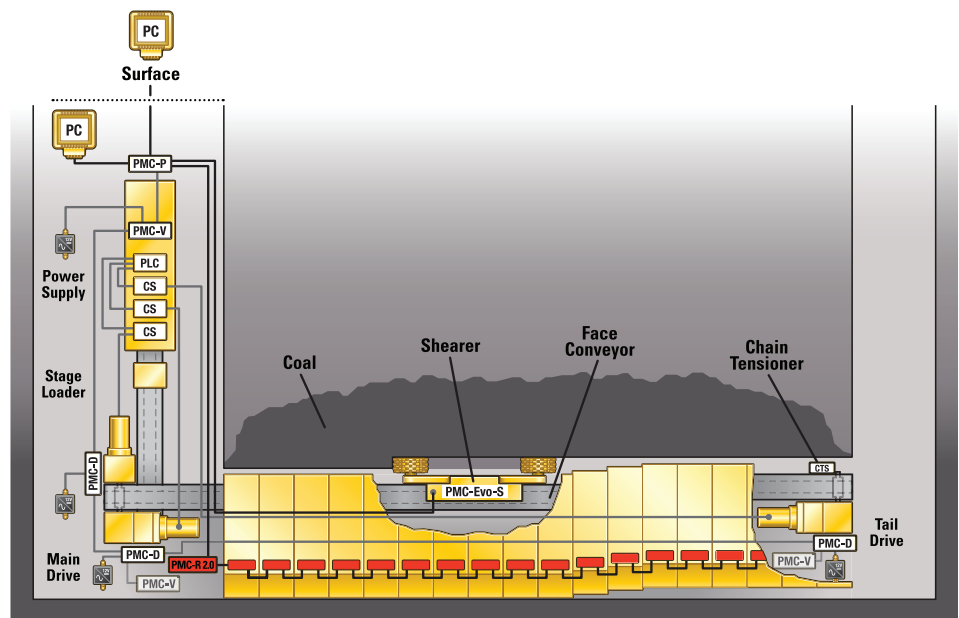
*Plow longwall*

# THE FAMILY OF PROGRAMMABLE MINING CONTROLS (PMC)

## A CONTROLLER FOR EVERY NEED

The PMC system offers a tailored control unit for each of the various longwall functions:

- + PMC-R 2.0 FOR ROOF SUPPORT SYSTEMS
- + PMC-D AS DRIVE CONTROL
- + PMC-V FOR VISUALIZATION AND PARAMETER SETUP OF THE DRIVE SYSTEM
- + PMC-P NODE COMPUTER TO ACT AS INTERFACE BETWEEN THE CAT CONTROLLER NETWORK, THIRD-PARTY SYSTEMS AND THE MINE COMPUTER. THE MODULE IMPLEMENTS DATA TRANSMISSION TO THE SURFACE VIA OPTICAL FIBER, MODEM OR COPPER WIRE.
- + MCU2 FOR VISUALIZATION AND CONTROL OF ALL LONGWALL OPERATIONS AT THE SURFACE OR WITH AN EXPLOSION-PROOF COMPUTER UNDERGROUND



## Features

### POWER

The PMC-R 2.0 control unit features a Cat A6 processor with 260 MHz clock speed and three 32-bit cores – a single core for application code and two redundant cores for functional safety. All other PMC control units use a 32-bit RISC CPU. The controls are programmed in a state-of-the-art programming language commonly used for control systems. This allows easy software review and changes, highest safety standards, and customized adjustment.

### RELIABILITY

The robust and highly resistant metal housing of the PMC-R 2.0 as well as the stainless-steel housing used for the other PMC controls feature maximum protection for highest reliability.

### NETWORKING

Caterpillar has developed a control system that treats the entire longwall as a single integrated machine. Within this system PMC-D (Drive) and PMC-V (Visualization) controllers are networked using the field bus system. This allows high-speed communication via one twisted cable pair over a range of up to 7 km (4.3 mi) without repeaters.



## MODULARITY

Because PMC controllers are modular, each tailored control is located next to the device it is controlling. This minimizes data transfer problems and simplifies troubleshooting.

## RIGOROUS TESTING

All components are designed and manufactured in accordance with the latest standards and are subject to strict quality control. Circuit boards use the latest surface-mount technology and are secured in special trays to provide superior protection against shock and vibration. Rigorous quality control testing such as function control, vibration and pressure testing ensures the highest in-service reliability of the finished product. Each unit is tested underwater in accordance to IP68.

## EXPLOSION-PROOF

The PMC family complies with international standards, governing intrinsically safe and explosion-proof systems such as EN 1804 part 4, and meets the majority of mechanical and environmental requirements of operators worldwide – one design, worldwide approval.

## ROBUSTNESS

The PMC family is based on the experience gained with over 20,000 installed units worldwide. With housings made of resistant metal and stainless steel, the control units and peripherals are protected from dust and water ingress and have an IP68 rating.

This results in high reliability, high availability and low failure rates over a long service life.

## FUNCTIONALITY

The basic system offers extensive functionality, including:

- + AUTOMATIC SETUP OF THE COMMUNICATION BETWEEN THE CONTROL UNITS OF THE ENTIRE SYSTEM
- + CONTROLLING AND SETTING OF PARAMETERS FOR THE SYSTEM
- + MEASURED VALUE HANDLING
- + DISTRIBUTION OF INFORMATION AND ERROR MESSAGES
- + LOGBOOK
- + LOADING OF APPLICATION SOFTWARE ONTO THE ENTIRE SYSTEM
- + VISUALIZATION IN DIFFERENT LANGUAGES, INCLUDING ENGLISH, CHINESE AND RUSSIAN



Configuration of PMC-D and PMC-V connected to a CST drive



PMC controllers are protected by stainless steel housings to withstand harshest conditions underground

# PMC-R 2.0

## NEXT GENERATION INTELLIGENCE FOR ROOF SUPPORTS



The Cat PMC-R 2.0 system represents the next-generation, state-of-the-art Cat automated control unit for longwall roof support applications. Based on the successful predecessor PMC-R, it combines the best features of that system with additional features required by longwall operations. The result is an innovative electrohydraulic shield control contributing to full automation of the advancing longwall. Designed to meet longwall mining needs well into the future, it can be used as part of an integrated longwall control system or as a stand-alone controller for underground mining applications such as chain tensioning. Third-party systems can also be integrated via a serial interface.

### A CONTROLLER IN EACH ROOF SUPPORT

The intrinsically safe Cat PMC-R 2.0 control units are specifically designed to be used on shearer or plow faces to provide high levels of longwall automation. The PMC-R 2.0 unit controls and displays all functions of a roof support and serves as the interface between operator and machine. Each roof support is equipped with one PMC-R 2.0 control unit and solenoid driver to operate the in-shield hydraulic functions and peripheral components, such as sensors for cylinder pressure and stroke length, shield inclination and Personnel Proximity Detection (PPD).

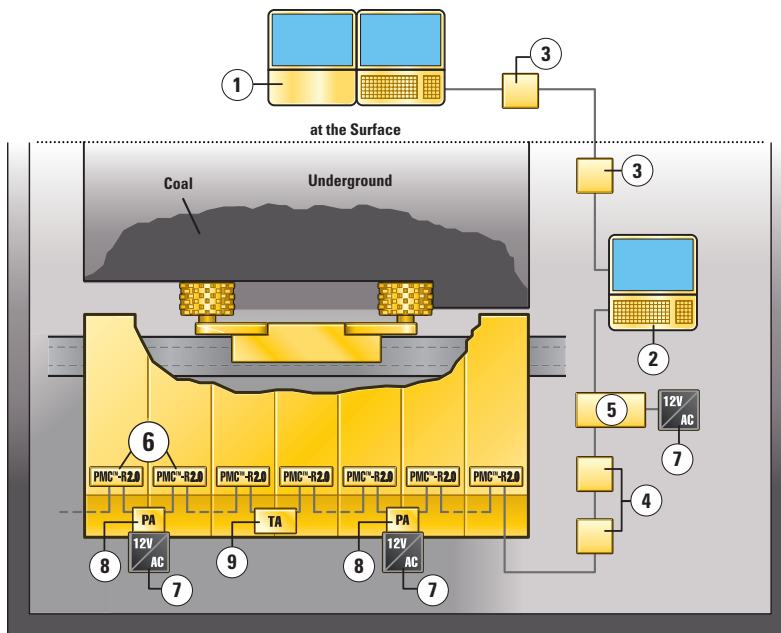
All PMC-R 2.0 controls include a face operating program, creating a network of independent logical controls, allowing multiple face operations to be performed simultaneously. Faults are easily diagnosed and repaired because each PMC-R 2.0 can interrogate its neighbors to quickly determine the source of the problem. The PMC-R 2.0 controls are identical, can be exchanged with any other PMC-R 2.0 control unit and are immediately accepted in a new face position without the need for any identification or termination plugs.

### INTERACTIVITY

This interactive system allows users to execute single shield and automatic functions, as well as remote controlled functions, from anywhere in the mine including the surface. To provide feedback for the operator, important process values are continuously displayed on a full-color display.

### HIGH-SPEED DATA TRANSMISSION

The PMC-R 2.0 control unit delivers fast 100M/Bit Ethernet communication, enabling real-time system feedback and data refresh rates for remote control operation. The low latency connection also means process data values are updated much faster for higher resolution when data logging and reviewing historical trending. An enhanced user experience is provided when viewing Cat 3D VSoftware applications as the data is refreshed at a higher frequency resulting in a smoother and more accurate representation of the equipment underground.



- 1 Visualization and control unit (MCU2) at the surface
- 2 MCU2 underground
- 3 Data transmission underground to surface control unit
- 4 Data transmission Shield Control Unit (SCU) to server PMC-R 2.0
- 5 Server PMC-R 2.0
- 6 SCU PMC-R 2.0
- 7 Power supply
- 8 Power adapter integrated into power supply
- 9 Isolation adapter

## ADVANCED FUNCTIONALITIES

The high bandwidth connection enhances machine-to-machine integration which provides for advanced automation functionality. More complex messages can be exchanged between the equipment, creating holistic integration and interoperability resulting in increased performance and reliability.

### ENHANCED COMPUTING POWER

The PMC-R 2.0 contains a Cat A6 family/3 core controller for enhanced communications and safety. The advanced processor features 260 MHz clock speed which is 9.5 times higher compared to predecessor model PMC-R.

### ROBUST, USER-FRIENDLY INTERFACE

Commands are entered via 34 keys on the front panel of the unit. These are clearly identified by function symbols. The keyboard provides tactile feedback, giving operators a clear indication of the validity of their entries. Each entry is also confirmed visually by an LED integrated into each key and by a beep.

### CUSTOM KEYS AND IMPROVED DISPLAY CONCEPT

The new 34-key keypad allows many additional special functions to be assigned to membrane keys, eliminating access problems for customer-specific software functions.

The system information is viewed via an improved graphical 66 mm (2.6 in) LCD display with 65 K color and 320 × 240 pixel which is easy to read from different angles. The display area is enlarged by 160% compared to predecessor PMC-R and shows 50% more information at a glance.

The information default display shows the main face data, such as leg pressure, ram cylinder stroke, shield number or shearer/plow position. Error messages are displayed, if any occur. The LCD display can also display Cyrillic and Chinese characters.

*(continued on next page)*

# PMC-R 2.0

## NEXT GENERATION INTELLIGENCE FOR ROOF SUPPORTS

### ADVANCED FUNCTIONALITIES *(continued)*

#### SYSTEM SOFTWARE

There is an extensive and mature library of software for all mining methods, including, for example, control of bi-directional adjacent neighbor functions, limited remote control for single functions of up to five shields (visible range) in standard faces and remote control in faces without operators. Functions such as batches and bank push, etc. are included, as well as roof support functions initiated based on shearer position. The shearer position is monitored by infrared or communication link.

#### SIMPLE ACCESS

The menu provides access to all data available in the roof support. This includes all sensor values, status information and local parameters, etc.

System information – such as global parameters and network status – are also accessible. Parameters can easily be changed at any control unit in the system, eliminating the need to employ the use of a master computer to perform this task. Parameter change can be password protected.

#### PERIPHERAL EQUIPMENT

- + NEW ISOLATION COUPLER WITH/WITHOUT POWER SUPPLY CONNECTION
- + CAN BASED CODE PLUG
- + SOLENOID DRIVER BOARD – WITH MULTIPLE CONNECTIONS FOR ENHANCED ROOF SUPPORT AUTOMATION
- + SOLENOID DRIVER, REED ROD AND PRESSURE SENSOR CAN BE USED FROM PREVIOUS PMC-R VERSION
- + PPD SYSTEM
- + INFRARED TRANSMITTER AND SENSORS FOR SHEARER POSITION TRACKING
- + LED WARNING LIGHT
- + ETHERNET MEDIA CONVERTER FOR DIVERSE DATA COMMUNICATION WITH MINE WIDE FIBER AND COPPER NETWORKS
- + SHIELD HEIGHT MEASUREMENT SYSTEM

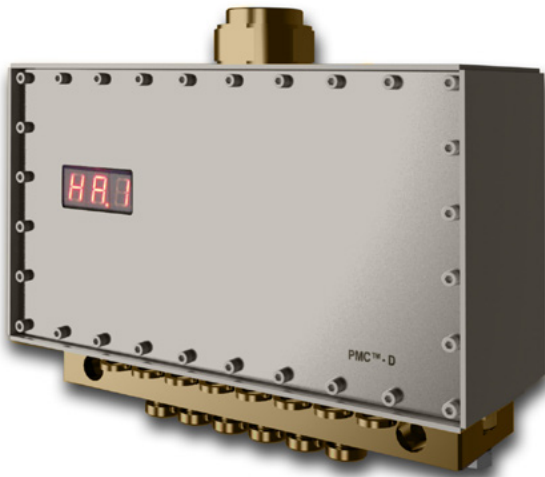


SKK 24 mini connections on backside



# PMC-D

## DEDICATED DRIVE CONTROL



In combination with Cat Controlled Start Transmission (CST) drives, the PMC-D controller offers control of AFC drives with unparalleled integration of overall system control. Typically dedicated to a gearbox or drive and mounted close to it, the PMC-D contains all the necessary hardware and tried-and-tested CST control algorithms to control a drive system effectively. The drive control software is based on that used in other members of the PMC family.

Connected to a junction box in the CST gearbox, the PMC-D collects all gearbox data (clutch pressure, oil temperature, input and output speed), calculates the necessary slip and controls the pressure for the CST clutch via a high-speed proportional valve.

## SMOOTH OPERATOR

Enhanced control functions offered by the 32-bit RISC technology allow an extended function range and state-of-the-art control features including more reliable and smoothly controllable overload function, estimation of remaining lifetime, and automatically controlled creep speed.

## POWERFUL STANDARD SOFTWARE

Software is available for various modes of operation of CST systems, including sequential no-load motor startup, synchronized AFC soft-start and heavy-load startup, accurate load sharing, fast overload protection and data logging.

## SENSORS FOR EVERYTHING

The PMC-D supports a wide range of sensors for use in CST systems, including:

- + PRESSURE SENSORS FOR CLUTCH PRESSURE AND COOLING OIL PRESSURE
- + PRESSURE SWITCH FOR SYSTEM PUMP PRESSURE AND HIGH-PRESSURE FILTER
- + TEMPERATURE SENSORS FOR OIL SUMP AND CLUTCH DISC
- + STROKE SENSOR USED FOR OIL LEVEL
- + PROXIMITY SWITCHES FOR INPUT AND OUTPUT SPEED

## CONTROLLED START TRANSMISSION

Cat CST drives with PMC-D control unit offer high power with safe startup of the face conveyor, full utilization of installed power, long service life and compact dimensions. Cat CST drives offer:

- + INTELLIGENT COMPACT DRIVE FOR LONGWALL CONVEYORS WITH UP TO 1200 KW (1,930 HP) DRIVE POWER
- + MAXIMUM SHORT-DURATION OUTPUT TORQUE (3 SEC) OF 650 000 N·M (479,415 LBF-FT)
- + CLUTCH DELIVERS MAXIMUM EFFICIENCY WITH MINIMUM OPERATIONAL SLIP
- + MINIMAL ENERGY LOSS AND HEAT DISSIPATION
- + VERY PRECISE SPEED AND TORQUE CONTROL USING A HIGH-DYNAMIC CLUTCH
- + FREELY SELECTABLE PARAMETERS FOR STARTUP, LOAD SHARING AND OVERLOAD PROTECTION

## OTHER FUNCTIONS

PMC-D can also be used for the following applications:

- + FULLY AUTOMATED CHAIN TENSIONING SYSTEM FOR CAT CHAIN CONVEYORS
- + ANY UNDERGROUND DRIVE SYSTEM WITH SENSORS AND ACTUATORS
- + ROOM AND PILLAR EQUIPMENT
- + BELT CONVEYOR SYSTEMS
- + PMC-D/20 FOR ADDITIONAL TRANSMISSION OF CONDITION MONITORING DATA

# PMC-V

## USER-FRIENDLY VISUALIZATION



The PMC-V display shows all data available from the gearboxes. This includes all sensor values, status information, all global and local parameters, network status, etc. The change of parameters is easily possible with the 24-key numerical keypad. Important system parameters are password protected.

Every longwall with installed PMC-Ds must have at least one PMC-V. Most install three for operator convenience: one for the driver's cabin, one for the main drive and one for the tail drive.

The PMC-V can interrogate, access and display all parameters, data and error messages, as well as data of third-party equipment and power distribution equipment.

With interfaces to all controllers in the network, the PMC-V has a 10.16 cm (4.0 in) VGA display for data visualization and display of trends, graphics and error messages.

### USER-FRIENDLY INTERFACE

The PMC-V contains 24 keys for easy operation. Data is graphically presented either as an overview or in appropriate groups. Data can be printed out at the surface.

### CONTROL OF DRIVES

The PMC-V provides an operator interface to all installed PMC-D units. It allows the operator to set parameters and to store and view system data.

In addition to all data from gearboxes, the PMC-V can display messages in different languages including English, German, Russian and Chinese. A 24-key keypad facilitates operation and allows changes to parameter settings.





# MCU2

## VISUALIZATION AND CONTROL UNIT



### PC POWER UNDERGROUND

The master control unit MCU2 features an intrinsically safe and explosion-proof underground PC (ExPC) with a robust IPC architecture and external keyboard and mouse for reliable operation in hazardous areas. The MCU2 can also serve as the mining control center on the surface.

With state-of-the-art computer technology and a 483 mm (19 in) graphic display, the Cat MCU2 master control unit opens a completely new dimension of data processing, recording and visualization underground and/or in explosion-hazard areas.

The monitor of the MCU2 shows the visualization programs for the various control tasks from the Cat MineStar™ capability set Health for Longwall.

### RUGGEDIZED HOUSING

The explosion-protected housing, armored glass screen and waterproof keyboard with built-in mouse ensure that the MCU2 can work safely and efficiently even in dusty and explosion-hazard areas. Intrinsically safe ports and network connection guarantee smooth data exchange with other control systems.

### CERTIFIED SAFETY

Whether for comprehensive data acquisition, safe and secure data exchange with the surface, visualization of current longwall data or central control and maintenance of machines, our mine-safe computers meet all the hardware and software requirements for underground mining and has the ATEX certification (Group I). Our underground equipment meets regulatory requirements for key mining markets including Australia, China and the U.S.



Health for Longwall is a cost-effective and user-friendly data visualization and reporting tool. It comprises the Cat VSoftware suite which empowers you to efficiently view, manage and use machine data of your longwall mining system – so you can make informed maintenance decisions that help you maximize the life and availability of your equipment. They allow parameters to be read and set as well as visualization of operational data. Each component also allows logging of operational data and has a replay function for visualization.

+	VSHIELD	+	VBOOTEND
+	VPLOW	+	VCHAINTENSIONER
+	VSHEARER	+	VGRAPH3D
+	VDRIVE	+	VREPORT
+	VVFD	+	VCYCLECOUNT
+	VBSL		

The main view shows the actual conveyor position versus the targeted position in a multi-color graph. Prop pressure values and advancing stroke values measured are presented as bar charts. Information about the shield status as well as details on position and direction of movement of the mining machine complete the main view. The three-dimensional representation of the longwall is based on the same data as the two-dimensional representation of the master control unit. The MCU2 and the graphic program can be linked locally or through a network. The visualization capabilities are rounded off by 3D representations of the measured values; like the pressure distribution represented as a function of time and support number.

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## 12 PROGRAMMABLE MINING CONTROLS



# PMC-P

## BRINGING ALL TOGETHER

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The PMC-P (Provider) is a node computer that provides the interface between individual controllers and equipment and the computer network or third-party systems. It converts protocols to allow data exchange.

The PMC-P also coordinates elements of the longwall. For example, if the shearer is cutting large quantities of coal, it must either speed up the conveyor drives or, if that is not possible, slow down the shearer. It also passes shearer position data to drive controllers so that they can fold in the roof support flipper at the appropriate time to prevent collision.

Data transmission to the surface via optical fiber, modem or copper wire is also implemented by the PMC-P.

# TECHNICAL SPECIFICATIONS

See *cat.com* for complete specifications.

## PMC-R 2.0 ROOF SUPPORT CONTROL

### CPU/PROCESSOR DATA

Parameter	CPU Data
CPU	Cat® A6 family
Clock Frequency	Up to 260 MHz
Cores	3 core
Memory	8 MB internal FLASH ROM 32 MB external FLASH ROM

### ELECTRICAL DATA

Parameter	Typical Value	Maximum Ratings
Supply Voltage	12V DC	9V–13.2V
Power Supply Current	Not applicable	8.1 A (MSHA); 2.5 A (RoW)
Power Consumption	170mA/@12V	230mA/@12V

### ENVIRONMENTAL DATA

Parameter	Symbol	Typical Value	Maximum Ratings
Operating Temperature	T <sub>amb</sub>	20° C (68° F)	–20° C – +40° C (–4° F – +104° F)
Storage Temperature	T.	20° C (68° F)	–20° C – +60° C (–4° F – +140° F)

### CONNECTOR

Type	Symbol	Amount	Maximum Ratings
SKK 24 mini	X1-X6	6	8 A
SKK 24 mini	Y1-Y6	6	8 A

### OPTICAL DEVICES

Type		Amount	Maximum Ratings
LCD Display	Shield information	1	66 mm (2.6 in) – 320 × 240 pixel – color 64 K in use
Infra-Red LED	Shearer position detection	1	IRDA Standard receiver
LED indication 1	Status HMI	3	On/Off/Blinking – 1 × red, 2 × green
LED indication 2	Wireless Status*	2	On/Off/Blinking – 1 × green, 1 × yellow
LED indication 3	Big Jumbo LED	3	On/Off/Blinking – 1 × red, 1 × green, 1 × yellow
LED indication 4	Key Status	31	On/Off/Blinking – green

### ACOUSTIC DEVICES

Type	Amount	Maximum Ratings
Beeper	1	>= 90 dB

\*Radio approval pending.

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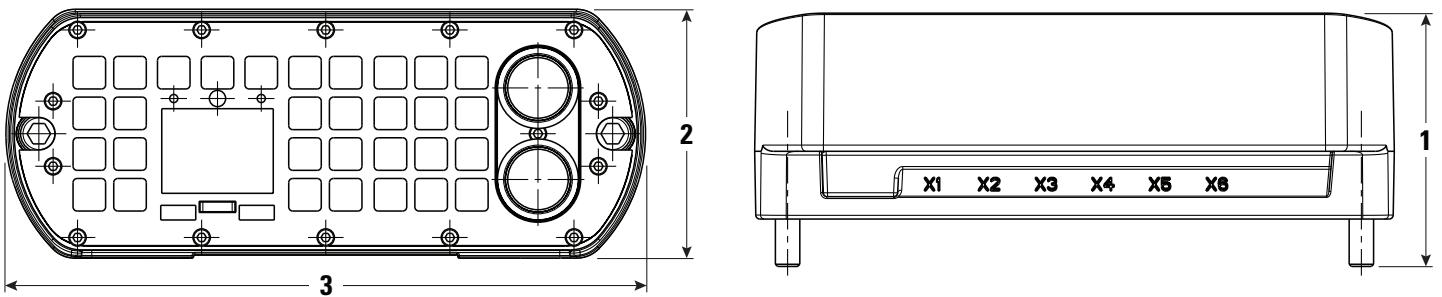


# TECHNICAL SPECIFICATIONS

See *cat.com* for complete specifications.

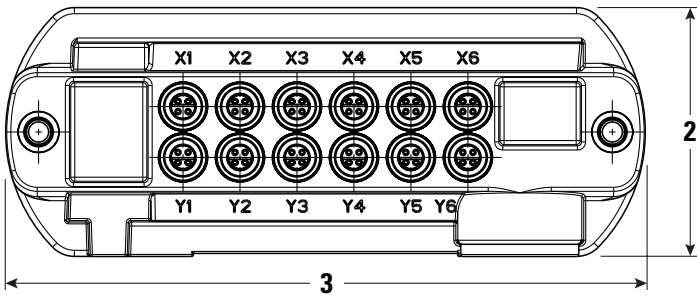
## PMC-R 2.0 ROOF SUPPORT CONTROL *(continued)*

**DIMENSIONS** (All dimensions are approximate.)



**Front and Side View**

1 Width	124 mm	4.88 in
2 Height	122 mm	4.80 in
3 Length	314 mm	12.36 in



**Rear View**

2 Height	122 mm	4.80 in
3 Length	314 mm	12.36 in

SKK Connector fits to existing Cat brass bar.

# TECHNICAL SPECIFICATIONS

See *cat.com* for complete specifications.

## PMC-D/PMC-D20 DRIVE CONTROL UNIT

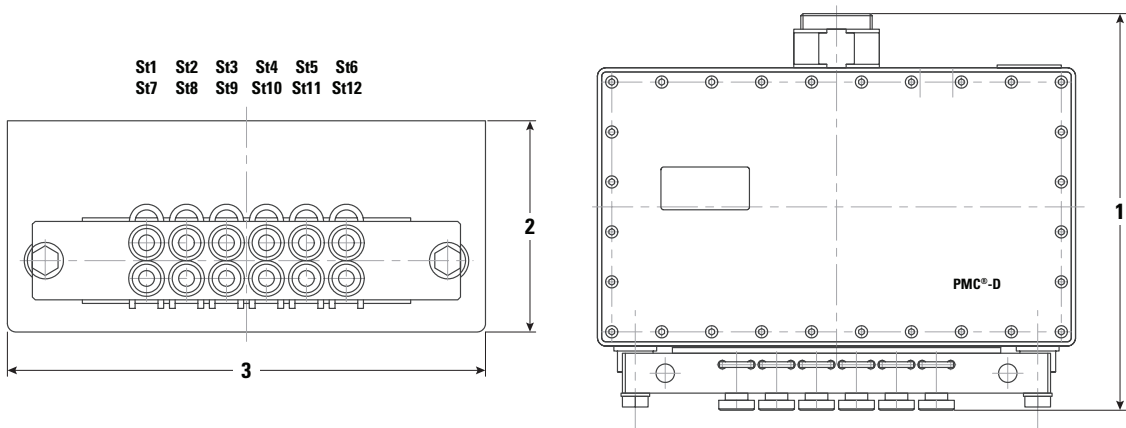
### ELECTRICAL DATA

Parameter	Typical Value	Maximum Ratings
Supply Voltage	12 V DC	9.5 V – 13.2 V
Supply Current	1 A	1.5 A

### ENVIRONMENTAL DATA

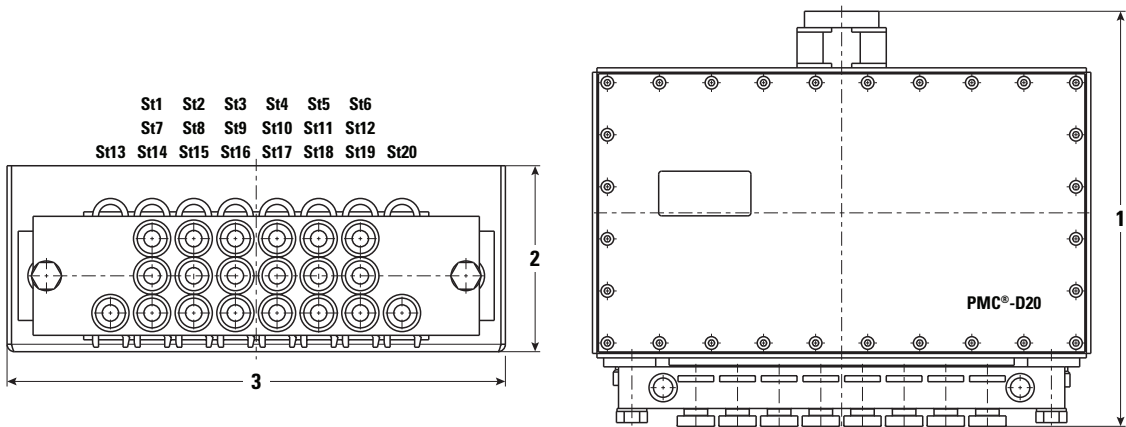
Parameter	Symbol	Typical Value	Maximum Ratings
Temperature	T <sub>amb</sub>	20° C (68° F)	–20° C – +40° C (–4° F – +104° F)

### DIMENSIONS AND PLUG ASSIGNMENTS (All dimensions are approximate.)



#### PMC-D

1 Width	278 mm	10.94 in
2 Height	148 mm	5.83 in
3 Length	335 mm	13.19 in



#### PMC-D20

1 Width	279 mm	10.98 in
2 Height	125 mm	4.92 in
3 Length	335 mm	13.19 in

(continued on next page)

# TECHNICAL SPECIFICATIONS

See *cat.com* for complete specifications.

## PMC-D/PMC-D20 DRIVE CONTROL UNIT *(continued)*

### ELECTRICAL SOCKETS

Socket	Pin 1	Pin 2	Pin 3	Pin 4
St1	Optocoupler Anode	Relay Contact NO: a	Relay Contact NO: b	Optocoupler Cathode
St2	+12 V (A) (output)	Serial Interface: RxD_0	Serial Interface: TxD_0	GND
St3	+12 V (B) (output)	Serial Interface: RxD_B	Serial Interface: TxD_B	GND
St4	+12 V (C) (output)	Serial Interface: RxD_C	Serial Interface: TxD_C	GND
St5	+12 V (C) (output)	Switch 1	Switch 2	GND
St6		Profibus: a (internal)	Profibus: b (internal)	
St7	+12 V (Power Supply)			GND (Power Supply)
St8	Multi Mode Input 4	Multi Mode Input 1	+8.2 V (output)	GND
St9	Multi Mode Input 5	Multi Mode Input 2	+8.2 V (output)	GND
St10	+12 V (output)	Multi Mode Input 3	+8.2 V (output)	GND
St11	+12 V (output)	Multi Mode Input 6	+8.2 V (output)	GND
St12		TP a	TP b	
St13		CM-Sensor +	CM-Sensor –	CM-GND
St14		CM-Sensor +	CM-Sensor –	CM-GND
St15		CM-Sensor +	CM-Sensor –	CM-GND
St16		CM-Sensor +	CM-Sensor –	CM-GND
St17		CM-Sensor +	CM-Sensor –	CM-GND
St18		CM-Sensor +	CM-Sensor –	CM-GND
St19		CM-Sensor +	CM-Sensor –	CM-GND
St20		CM-Sensor +	CM-Sensor –	CM-GND



# TECHNICAL SPECIFICATIONS

See *cat.com* for complete specifications.

## PMC-V HUMAN MACHINE INTERFACE FOR PMC-D DRIVE CONTROL SYSTEMS

### MAIN TECHNICAL DATA

320 × 240 pixel b/w graphics display
IP 68
Power: 12 W
12 SKK24 sockets for power supply, communication, sensors and actuators
Optional additional Profibus communication channel for communication with third party computer

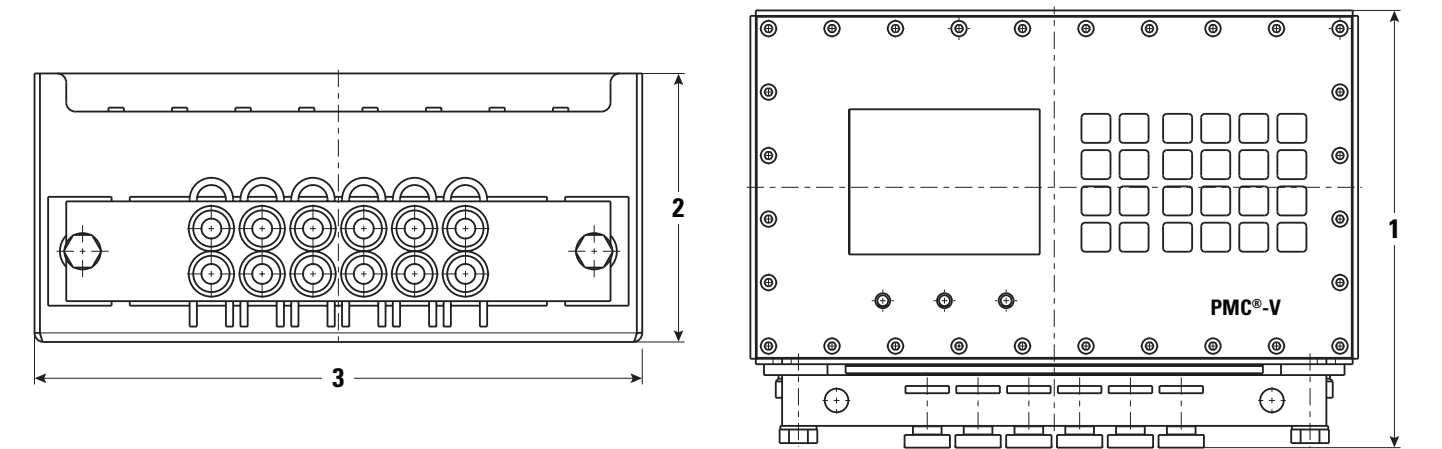
### ELECTRICAL DATA

Parameter	Typical Value	Maximum Ratings
Supply Voltage	12 V DC	9.5 V – 13.2 V
Supply Current	1 A	1.5 A

### ENVIRONMENTAL DATA

Parameter	Symbol	Typical Value	Maximum Ratings
Temperature	T <sub>amb</sub>	20° C (68° F)	–20° C – +40° C (–4° F – +104° F)

### DIMENSIONS (All dimensions are approximate.)



1 Width	241 mm	9.49 in
2 Height	148 mm	5.83 in
3 Length	335 mm	13.19 in

(continued on next page)

# TECHNICAL SPECIFICATIONS

See *cat.com* for complete specifications.

## PMC-V HUMAN MACHINE INTERFACE FOR PMC-D DRIVE CONTROL SYSTEMS *(continued)*

### ELECTRICAL SOCKETS

Socket	Pin 1	Pin 2	Pin 3	Pin 4
St1	Optocoupler Anode	Relay Contact NO: a	Relay Contact NO: b	Optocoupler Kathode
St2	+12 V (A)	Serial Interface: RxD	Serial Interface: TxD	GND
St3	+12 V (B)	Serial Interface: RxD	Serial Interface: TxD	GND
St4	+12 V (C)	Serial Interface: RxD	Serial Interface: TxD	GND
St5	Options	Options	Options	Options
St6		Profibus: a (internal)	Profibus: b (internal)	
St7	+12 V Input	Serial Interface: TxD	Serial Interface: RxD	GND Input
St8	+12 V (B)	Measurement Input 1	+8.2 V	GND
St9	+12 V (C)	Measurement Input 2	+8.2 V	GND
St10	+12 V (A)	Measurement Input 3	+8.2 V	GND
St11	Options	Options	Options	Options
St12		Profibus: a (internal)	Profibus: b (internal)	

### OPTIONS

The designations of the options equal the second and third to last characters of the type designation listed on the equipment.

Option	Socket	Pin 1	Pin 2	Pin 3	Pin 4
**	St5				
	St11				
AB	St5		Profibus: a (external)	Profibus: b (external)	
	St11		Profibus: a (external)	Profibus: b (external)	

# TECHNICAL SPECIFICATIONS

See *cat.com* for complete specifications.

## MCU2 MAIN CONTROL UNIT

### ELECTRICAL POWER SUPPLY

Power supply of the explosion-proof part, 110-240V AC
Power supply of the intrinsically safe part, 12V DC, maximum 2A
Non-intrinsically safe USB interface

### COMPONENTS

Processor	Intel Core i7, 2.1 GHz	
RAM Memory	4 GB	
Data Memory	2 × 120 GB SSD	
Hard Drive – 1 TB	6.4 cm	2.5 in
Display	48.3 cm	19 in
Resolution	1280:1024	
Operating System	Windows 7	
Input Equipment	Keyboard with integrated mouse	

### INTRINSICALLY SAFE INTERFACES

COM 1 BIDI SKK24
COM 2 BIDI SKK24
COM 3 BIDI SKK24
COM 4 BIDI SKK24
Ethernet via Fiber-Optic Cable – 9 µm

### CERTIFICATIONS AND IDENTIFICATION

Certification	ATEX (within system: MA and GOST)	
Type of Protection	I M2 EEx ib I	
Temperature Range	–20° C to +60° C	–4° F to +140° F

### Weight

Approximate Weight	200 kg	441 lb
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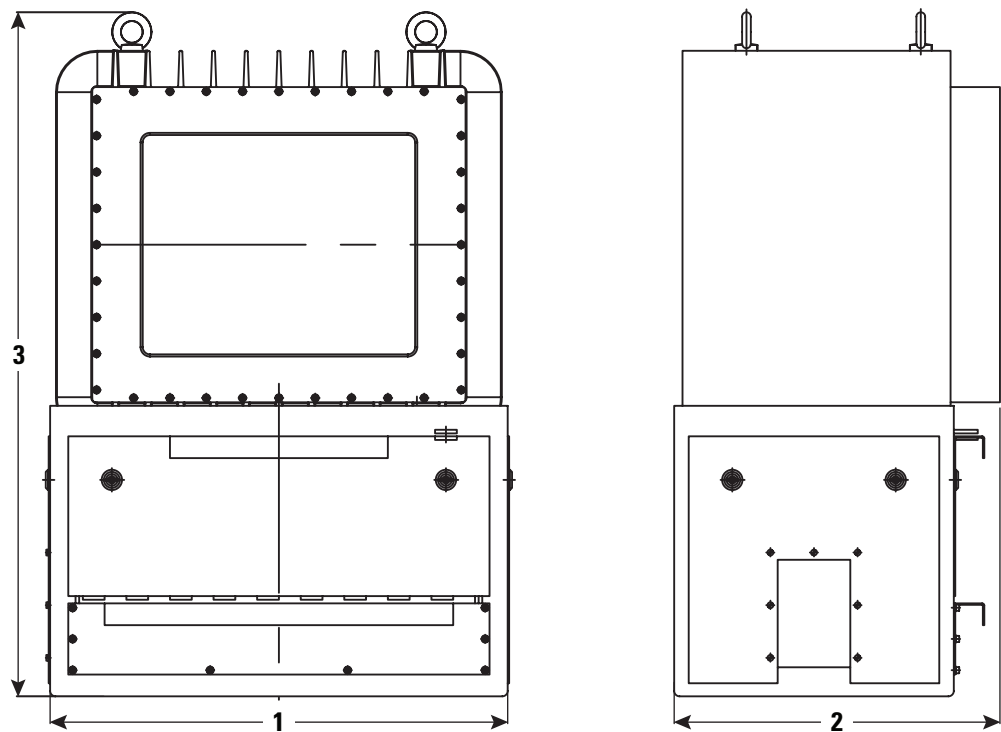


# TECHNICAL SPECIFICATIONS

See *cat.com* for complete specifications.

## MCU2 MAIN CONTROL UNIT *(continued)*

**DIMENSIONS** (All dimensions are approximate.)



1 Width	630 mm	24.80 in
2 Height	450 mm	17.72 in
3 Length		
Small Base	945 mm	37.20 in
Large Base	1145 mm	45.08 in







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AEXQ3214  
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