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Control System



77XR-S-E-SC-EN-0005

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Preface

This Manual is provided as a guide to personnel involved with the operation, maintenance and repair of Komatsu mining equipment. We recommend that such personnel review and become familiar with the general procedures and information contained within this manual. In addition, we recommend that this manual be kept readily available for reference when repairs or maintenance are necessary.

Read and become familiar with this Manual and any other general safety practices before attempting any procedures.

Due to the complexities of mining equipment and the environment in which it operates, situations may arise which are not directly discussed in detail in this Manual. When such a situation arises, past experience, availability of equipment and common sense play a large part in what steps are to be taken. In addition, a Komatsu Mining service center representative is available to answer your questions and assist you upon request.

Komatsu Mining reserves the right to continually improve its products and associated documentation. Therefore, physical alterations to Komatsu equipment may not be identified in this Manual. Revisions may be frequently made to this Manual in an effort to ensure that information contained within is current as alterations occur to the equipment. If you find an error or have other feedback regarding this Manual, please contact Product Training and Publications at *Pro.Train.Pub@joyglobal.com*.

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Overview

Theory Of Operation

Refer to **Figure 1 : Control System (Simplified) Diagram**.

The control system includes all of supporting electrical components that monitor, facilitate, and actuate the multiple functions available on the drill.

The central most component is the vehicle control unit (**04, Figure 1**) (also referred to as the machine controller). It provides the overall “brains” that supervises everything on the machine. Software loaded onto the machine controller dictates how it will direct functions on the machine. The software tells the machine controller what to do, when it receives signals from component inputs.

The HMI controller (**03, Figure 1**) takes all of the operator’s inputs received from the operator’s touch screen (**02, Figure 1**) and communicates them to the vehicle control unit (**04, Figure 1**). The connect between the VCU and HMI (**18, Figure 1**) serves to communicate notices, warnings, and alarms (machine feedback) via the touch screen (**15, Figure 1**). Additionally, the connection provides a means for data logging (**17, Figure 1**). The VCU collects data and transmits it to the HMI controller, the operator then connect to the HMI (via an external USB port) to download the aforementioned data. The touch screen (**02, Figure 1**) provides for some operator and technician level parameters, that can be used to customize the machine’s operation. Refer to the *Touch Panel* system manual, for more information.

The operator’s joysticks and keypad switches (**01, Figure 1**) are connected via CAN to the VCU, as part of the cab network (**05, Figure 1**).

A total of up to nine CAN networks are present on the machine. Nine separate CAN networks (**05, 06, 07, 08, 09, 10, 11, 12, & 13 Figure 1**) are located on the machine. Each network is arranged with a specific number of electrical components that monitor and actuate, multiple functions of the drill. Networks are arranged by component locations, on the machine. Each CAN network constantly provides the machine controller with input data (**17, Figure 1**). The input data is used by the machine controller to dictates how the machine will react, as it is being operated.

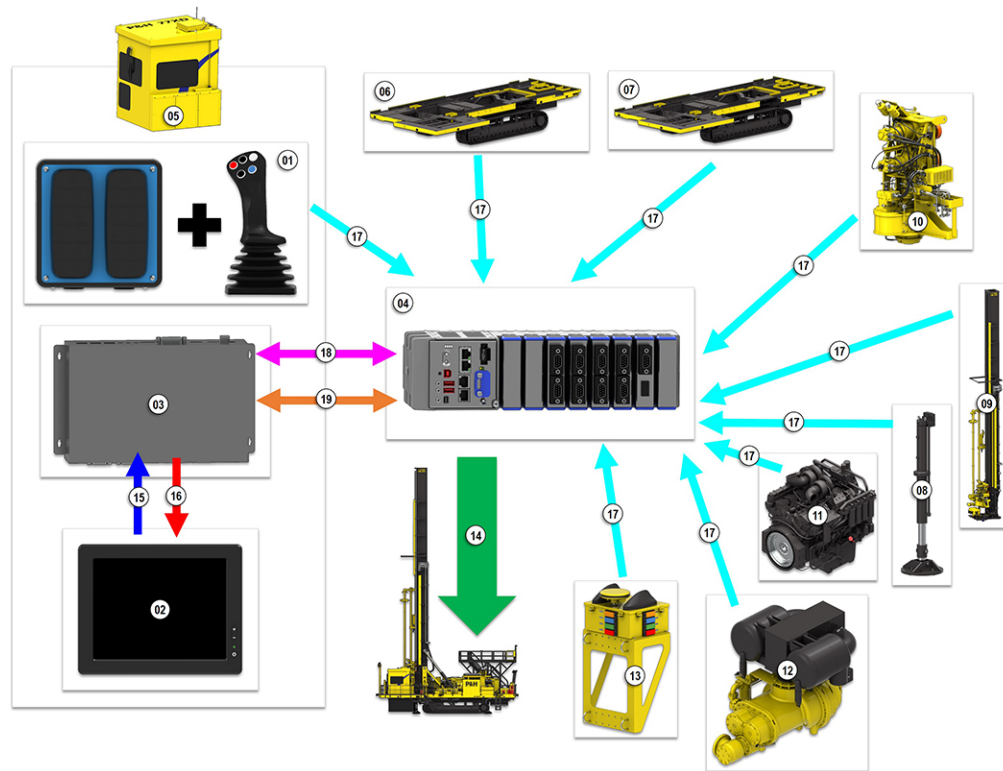
Each individual CAN network, is covered in greater detail, later in this document.

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Figure 1: Control System (Simplified) Diagram



01 - Operator's Controls
(Joysticks & Keypad
Switches)

02 - Operator's Touch Screen

03 - HMI (Human Machine
Interface) Controller

04 - VCU (Vehicle Control Unit
aka "Machine Controller")

05 - Cab Network

06 - Chassis Network 1

07 - Chassis Network 2

08 - Leveling Network

09 - Mast Network 1

10 - Mast Network 2 (Carriage)

11 - Diesel Engine Network

12 - Air Compressor (J1939)
Network

13 - Optional Drill Automation
Network

14 - Drill Operation

15 - Operator Input

16 - Machine Feedback

17 - CAN Network Input

18 - Control Inputs

19 - Data Logging

CAN Bus Networks

The vast majority of electrical components on the drill are connected via a CAN Bus Network.

The CAN Bus or Controller Area Network, is a specialized communication network that interconnects electrical components. It is ideal for mobile equipment because, it drastically reduces the total length of wire necessary to connect components.

Instead of placing all electrical components on one master network, the machine utilizes eight smaller (more specific) networks. This was a purposeful decision. From a practical perspective, if all components were on one master network and a component failed; troubleshooting would be much more involved. By having smaller dedicated networks, it reduces the amount of components that need to be investigated when troubleshooting a problem. This will not necessarily solve the problem faster, but it will limit the overall scope of the investigation.

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Cab Network

Refer to **Figure 2 : Cab Network**.

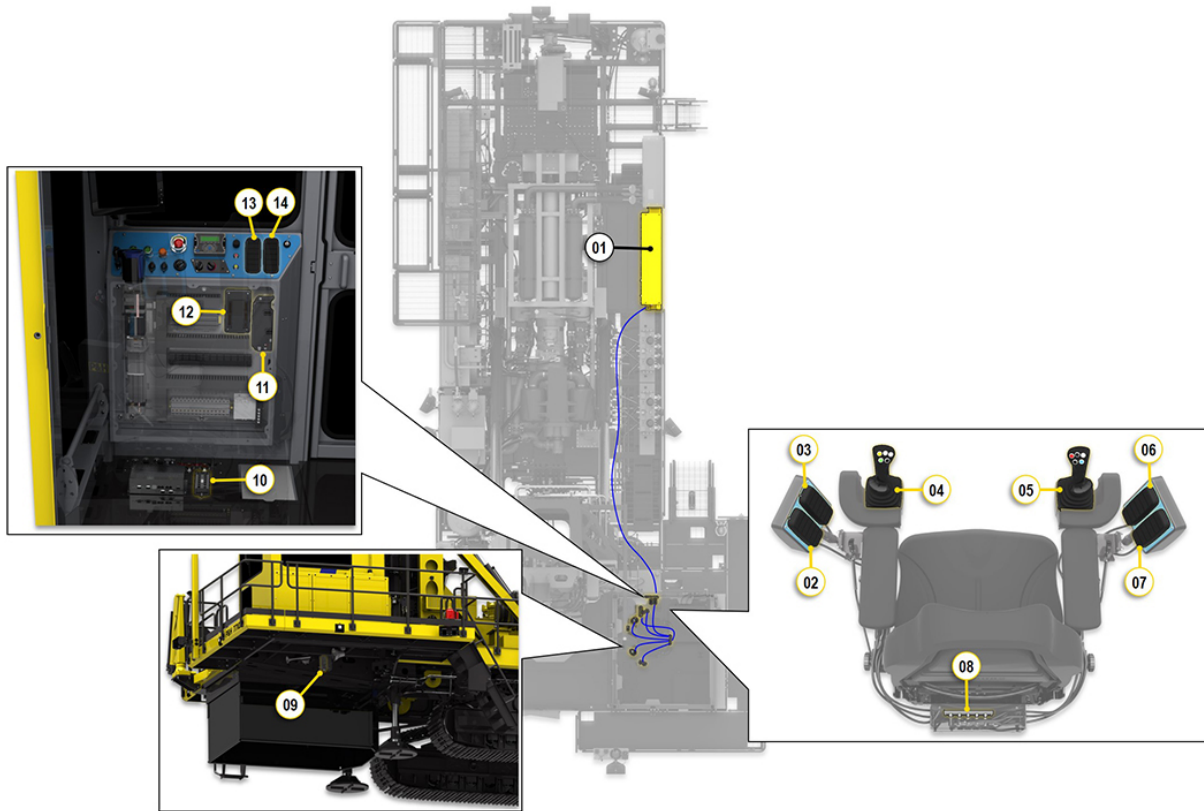
Note: The blue cabling shown in **Figure 2**, is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

The Cab Network starts at the control cabinet (**01, Figure 2**). The primary CAN trunk line connects the control cabinet, to the mast cylinders, and on to the controls located inside the operator's cab.

All of the operator's keypads (**02, 03, 06, 07, 13, & 14, Figure 2**) and joysticks (**04 & 05, Figure 2**) are connected via branch lines to the distribution block (**08, Figure 2**) located on the back side of the operator's chair.

The Cab Network is terminated at the cab control 12 port CAN distribution block (**10, Figure 2**).

Figure 2: Cab Network



- | | | |
|------------------------------|--|--|
| 01 - Control Cabinet | 08 - DB_CCCD – Cab Chair 10 Port CAN Distribution Block | 11 - IO_CPOM – Cab Power Output Module |
| 02 - KP_L1 - Left Keypad #1 | 09 - IO_RD – Rear Deck I/O Module | 12 - IO_MC – Cab I/O Module |
| 03 - KP_L2 – Left Keypad #2 | 10 - DB_CCC – Cab Control 12 Port CAN Distribution Block | 13 - KP_C1 – Dash Keypad #1 |
| 04 - JS_LH – Left Joystick | | 14 - KP_C2 – Dash Keypad #2 |
| 05 - JS_RH – Right Joystick | | |
| 06 - KP_R1 – Right Keypad #1 | | |
| 07 - KP_R2 – Right Keypad #2 | | |

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Chassis Network 1

Refer to **Figure 3 : Chassis Network 1**.

Note: The blue cabling shown in **Figure 3**, is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling used to connect components on the actual machine.

The Chassis Network 1 starts at the control cabinet (**01, Figure 3**). The primary CAN trunk line connects the control cabinet to the components adjacent to the left side of the power unit.

Branch lines connect the parking brake pressure transducer (**06, Figure 3**), transmission RTD module (**07, Figure 3**), engine radiator (**08, Figure 3**) RTD module, and hydraulic radiator (**09, Figure 3**) RTD modules. Additionally connected are the hydraulic tank level transducer (**10, Figure 3**), both hydraulic tank I/O modules (**11 & 12, Figure 3**), and main air tank pressure & temperature transducer (**13, Figure 3**).

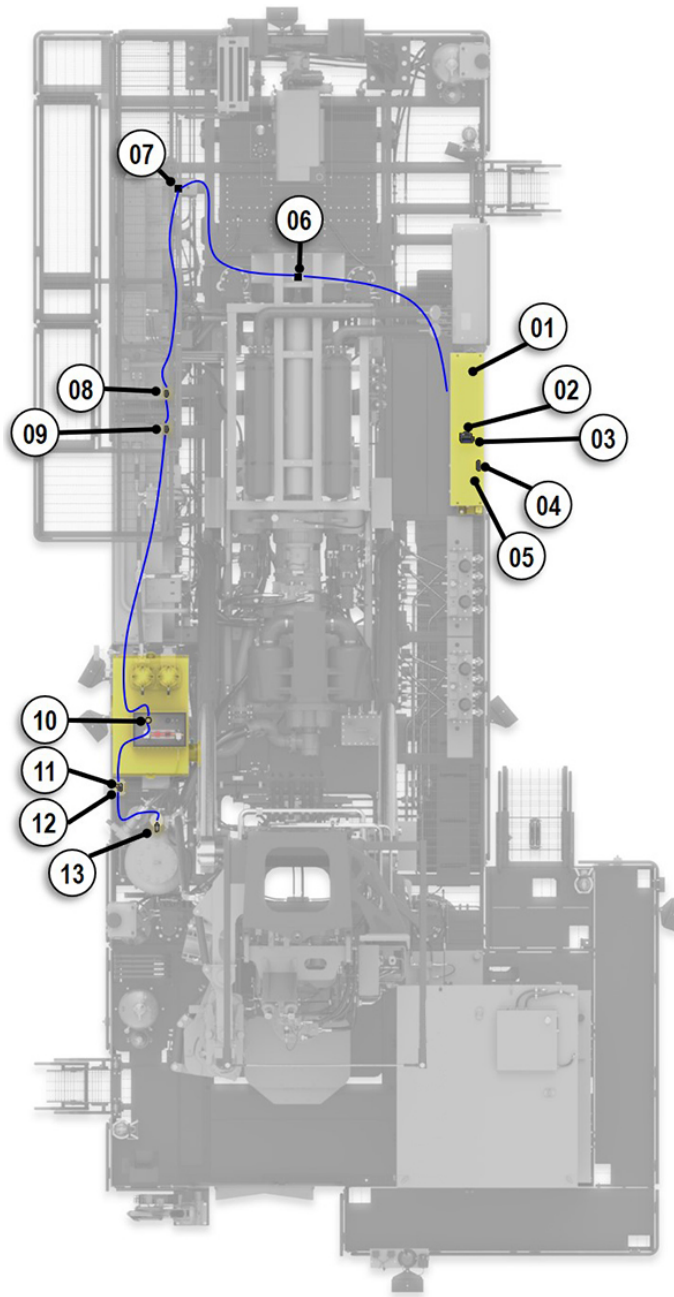
The Chassis Network 1 is terminated on the left side of the machine, just behind the hydraulic oil tank.

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Figure 3: Chassis Network 1



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01 - Control Cabinet	06 - PT_PPB – Parking Brake Pressure Transducer	10 - LT_HTFL – Hydraulic Tank Level Transducer
02 - IO_CLM – Chassis Lighting Module	07 - IO_TRAN – Transmission RTD Module	11 - IO_HTM1 – Hydraulic Tank I/O Module (Upper)
03 - RP_RECVR – Remote Propel Receiver (optional)	08 - IO_ENG – Engine Radiator 4 RTD CANopen Module	12 - IO_HTM2 – Hydraulic Tank I/O Module (Lower)
04 - IO_CCM - Control Cabinet I/O Module	09 - IO_CC – Hydraulic Radiator 4 RTD CANopen Module	13 - TPP_CAOR – Main Air Tank Pressure & Temperature Transducer
05 - IO_CCMA – Control Cabinet I/O Module A		

Chassis Network 2

Refer to [Figure 4 : Chassis Network 2](#).

Note: The blue cabling shown in [Figure 4](#), is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

The Chassis Network 2 starts at the control cabinet (**01**, [Figure 4](#)). The primary CAN trunk line connects the control cabinet to the terminating resistor.

All of the I/O modules (**02, 03, 04, 05, 08, & 09**, [Figure 4](#)), the auxiliary (**06**, [Figure 4](#)) and fan drive (**07**, [Figure 4](#)) pump pressure transducers, the air compressor inlet pressure transducer (**10**, [Figure 4](#)) are connected via branch lines.

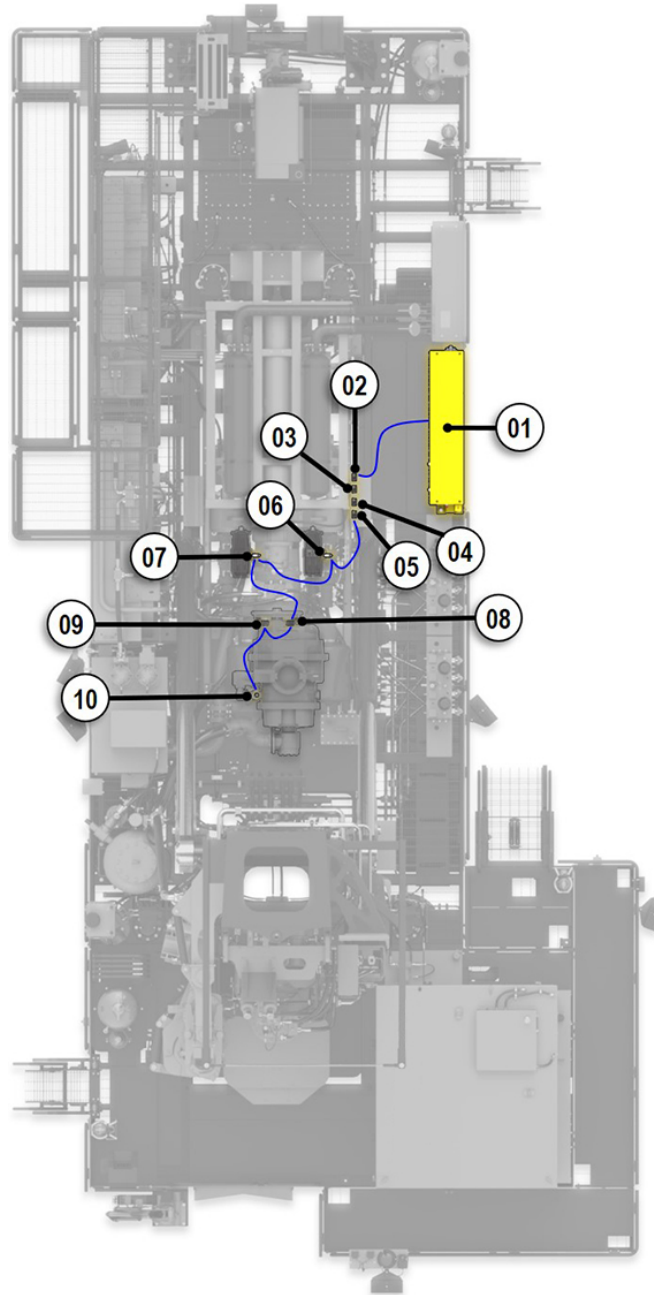
The Chassis Network 2 is terminated on the left side of the machine, near the hydraulic oil tank filters.

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Figure 4: Chassis Network 2



01 - Control Cabinet

02 - IO_PS - Power Skid I/O Module

03 - IO_HD - Hydraulic Diverter I/O Module

04 - IO_HP V - Hydraulic Pump Valve I/O Module

05 - IO_HPS - Hydraulic Pump Sensor I/O Module

06 - PT_HPA - Auxiliary Hydraulic Pump Load Pressure Transducer

07 - PT_HPC - Fan Drive Hydraulic Pump Load Pressure Transducer

08 - IO_REAR - Rear I/O Module

09 - IO_GT - Grease Tank I/O Module

10 - PT_COIP - Air Compressor Inlet Pressure Transducer

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Leveling Network

Refer to **Figure 5 : Leveling Network**.

Note: The blue cabling shown in **Figure 5**, is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

The Leveling Network starts at the control cabinet (**01, Figure 5**). The primary CAN trunk line connects the control cabinet to each individual leveling jack manifolds.

The front I/O module (**06, Figure 5**), fuel tank level transducer (**07, Figure 5**), water tank level transducer (**17, Figure 5**), leveling inclinometer (**16, Figure 5**), and all four main pump pressure transducers (**12, 13, 14, & 15, Figure 5**) are all connected via branch lines to the leveling network.

Each leveling jack has a corresponding extend/retract valve (**02, 08, 18, & 22, Figure 5**), a load pressure transducer (**03, 09, 19, & 23, Figure 5**), a demand pressure transducer (**04, 10, 20, & 24, Figure 5**), and a linear position transducer (**05, 11, 21, & 25, Figure 5**) that relay information to the machine controller.

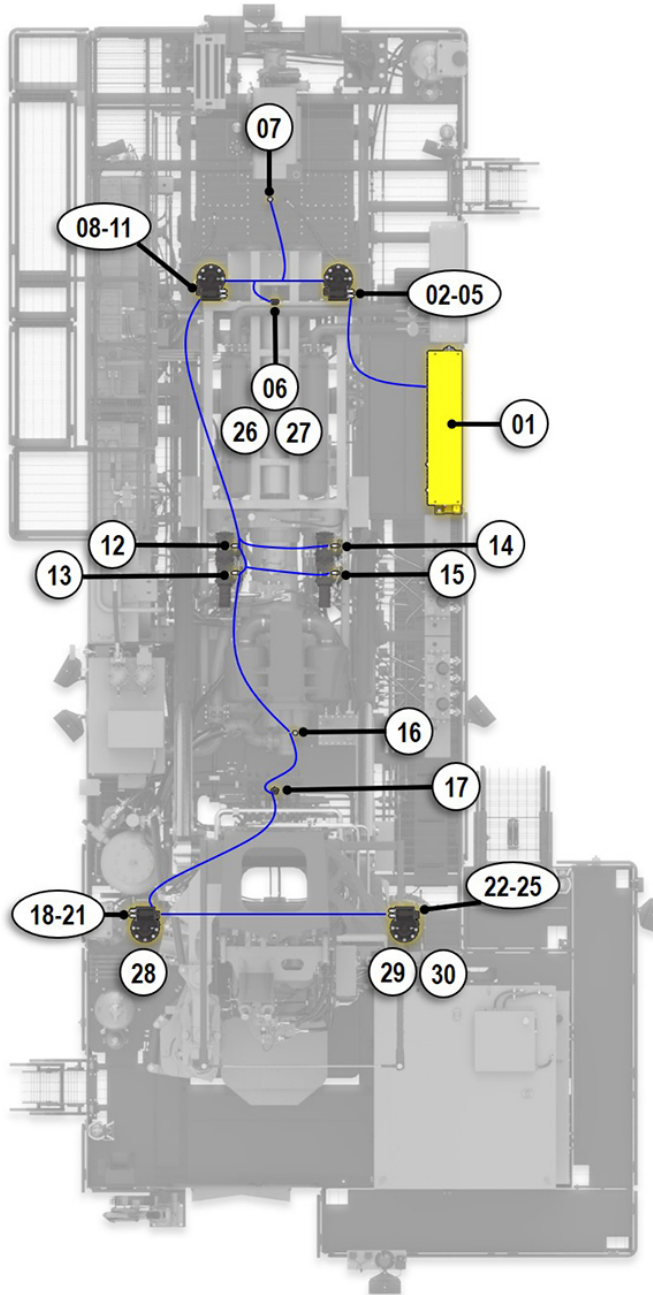
The Leveling Network is terminated at the right rear leveling jack manifold.

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Figure 5: Leveling Network



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- | | | |
|--|--|---|
| 01 - Control Cabinet | 11 - ZT_LJLF - Leveling Jack
Left Front Linear Position
Transducer | 21 - ZT_LJLR - Leveling Jack
Left Rear Linear Position
Transducer |
| 02 - SV_LJRF – Leveling Jack
Right Front Extend/Retract
Valve | 12 - PT_HPLTR - Left Main
Pump Reverse Pressure
Transducer | 22 - SV_LJRR - Leveling Jack
Right Rear Extend/Retract
Valve |
| 03 - PT_LJRFL – Leveling Jack
Right Front Load Pressure
Transducer | 13 - PT_HPLTF - Left Main
Pump Forward Pressure
Transducer | 23 - PT_LJRR1 – Leveling Jack
Right Rear Load Pressure
Transducer |
| 04 - PT_LJRFD – Leveling Jack
Right Front Demand
Pressure Transducer | 14 - PT_HPRRF - Right Main
Pump Forward Pressure
Transducer | 24 - PT_LJRR2 – Leveling Jack
Right Rear Demand
Pressure Transducer |
| 05 - ZT_LJRF – Leveling Jack
Right Front Linear
Position Transducer | 15 - PT_HPRRR - Right Main
Pump Reverse Pressure
Transducer | 25 - ZT_LJRR - Leveling Jack
Right Rear Linear Position
Transducer |
| 06 - IO_FRONT - Front I/O
Module | 16 - IN_LEV - Leveling
Inclinometer | 26 - DB_LJF1 – Leveling Jack
Front Distribution Block 1 |
| 07 - LT_EFTL – Engine Fuel
Tank Level Transducer | 17 - LT_DCWTL - Water Tank
Level Transducer | 27 - DB_LJF2 – Leveling Jack
Front Distribution Block 2 |
| 08 - SV_LJLF - Leveling Jack
Left Front Extend/Retract
Valve | 18 - SV_LJLR - Leveling Jack
Left Rear Extend/Retract
Valve | 28 - DB_LJLR – Leveling Jack
Left Rear Distribution
Block |
| 09 - PT_LJLFL – Leveling Jack
Left Front Load Pressure
Transducer | 19 - PT_LJLRL - Leveling Jack
Left Rear Load Pressure
Transducer | 29 - DB_LJRR1 – Leveling Jack
Right Rear Distribution
Block 1 |
| 10 - PT_LJLFD – Leveling Jack
Left Front Demand
Pressure Transducer | 20 - PT_LJLRD - Leveling Jack
Left Rear Demand
Pressure Transducer | 30 - DB_LJRR2 – Leveling Jack
Right Rear Distribution
Block 2 |

Mast Network 1

Refer to [Figure 6 : Mast Network 1](#).

Note: The blue cabling shown in [Figure 6](#), is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

The Mast Network 1 starts at the control cabinet (01, [Figure 6](#)). The primary CAN trunk line connects the control cabinet, around the A-frame, to the mast. The trunk lines wraps around the mast from the left side to the right side.

Most of the valve banks utilize a load pressure transducer (05 & 21, [Figure 6](#)) and a function proportional valve (06, 07, 10, 14, 20, & 22, [Figure 6](#)).

The pipe carousel (10, [Figure 6](#)), breakout wrench (12, [Figure 6](#)), slide wrench (15, [Figure 6](#)), and bit carousel (17, [Figure 6](#)) all utilize linear position transducers, that provide real-time positioning feedback to the machine controller. Additional positioning information is provided by the rotary encoders on the pipe carousel (13, [Figure 6](#)) and bit carousel (17, [Figure 6](#)) hydraulic motors.

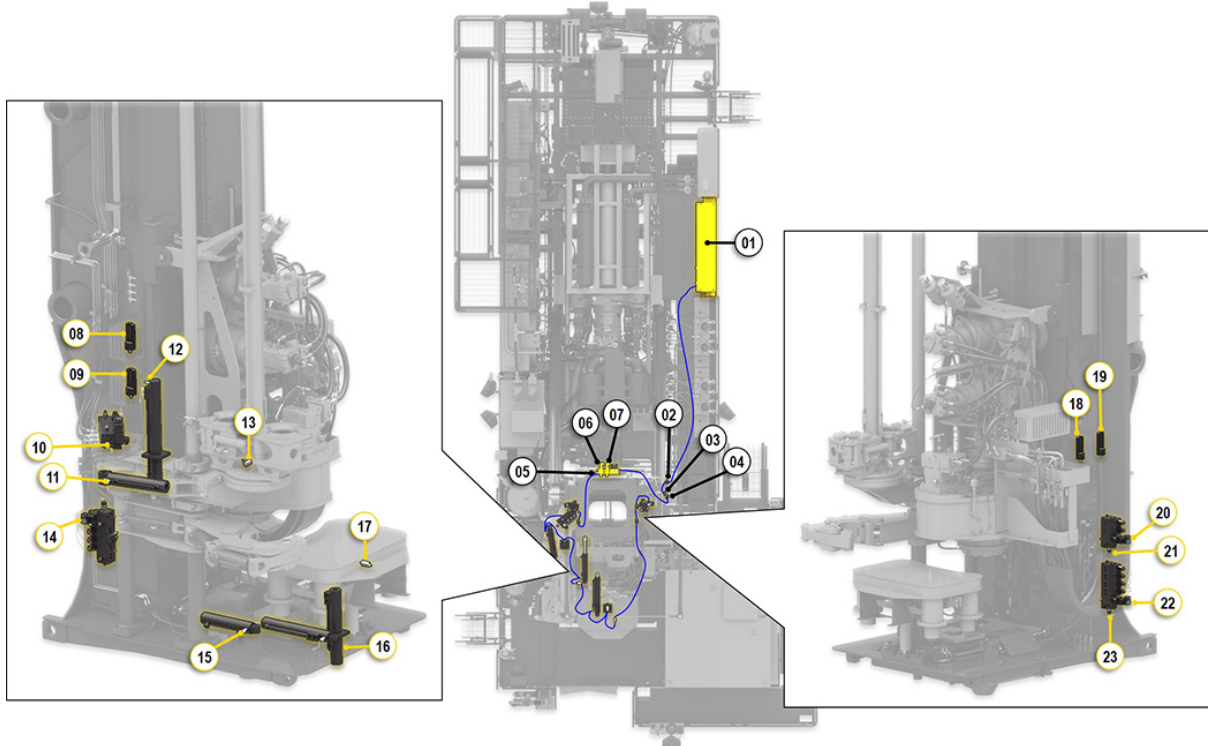
The Mast Network 1 is terminated on the right side of the rotary carriage.

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Figure 6: Mast Network 1



01 - Control Cabinet

02 - IO_AFIOM2 – A-Frame I/O Module #2

03 - IN_MAFAI – Mast A-Frame Accelerometer/ Inclinometer

04 - IO_AFIOM1 – A-Frame I/O Module #1

05 - PT_MFL – Mast Function Load Pressure Transducer (on VB1)

06 - SV_MRL – Mast Raise/Lower Function Proportional Valve (on VB1)

07 - SV_MFB – Mast Valve Bank Function Proportional Valve

08 - IO_MLLS2 – Mast Lower Left Side I/O Module #2

09 - IO_MLLS1 – Mast Lower Left Side I/O Module #1

10 - SV_PCFP – Pipe Carousel Function Proportional Valve (on VB2)

11 - ZT_PCLP – Pipe Carousel Linear Positioner Transducer

12 - ZT_PBWRL – Breakout Wrench Raise/Lower Linear Position Transducer

13 - EN_PC – Pipe Carousel Encoder

14 - SV_PBWFP – Breakout Wrench Function Proportional Valve (on VB3)

15 - ZT_PSWALP – Slide Wrench Linear Position Transducer

16 - ZT_BCER – Bit Basket Extend/Retract Linear Position Transducer

17 - EN_BCI – Bit Carousel Index Encoder

18 - IO_MLRS2 – Mast Lower Right Side I/O Module #2

19 - IO_MLRS1 – Mast Lower Right Side I/O Module #1

20 - SV_BCFP - Bit Carousel Function Proportional Valve (on VB5)

21 - PT_BCL - Bit Carousel Load Pressure Transducer (on VB5)

22 - SV_BPHFP - Bit/Pipe Handling Function Proportional Valve (on VB4)

23 - ZT_PSLP - Optional Lower Pipe Positioner Linear Transducer

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Mast Network 2

Refer to [Figure 7 : Mast Network 2](#).

Note: The blue cabling shown in [Figure 7](#) , is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

The Mast Network 2 starts at the traveling cable connection to the rotary carriage, the primary CAN trunk line is also connected here.

The mast middle I/O module ([02, Figure 7](#)) and mast accelerometer/inclinometer ([03, Figure 7](#)) connect to the remaining carriage components, via both carriage I/O modules ([08 & 09, Figure 7](#)).

Both rotary and pulldown manifolds rely on pressure transducers ([10, 11, 12, & 13, Figure 7](#)) for each direction of potential movement. The pressure transducer report back to the machine controller.

The carriage travel encoder ([05, Figure 7](#)) and rotary encoder ([06, Figure 7](#)) provide positioning feedback to the machine controller.

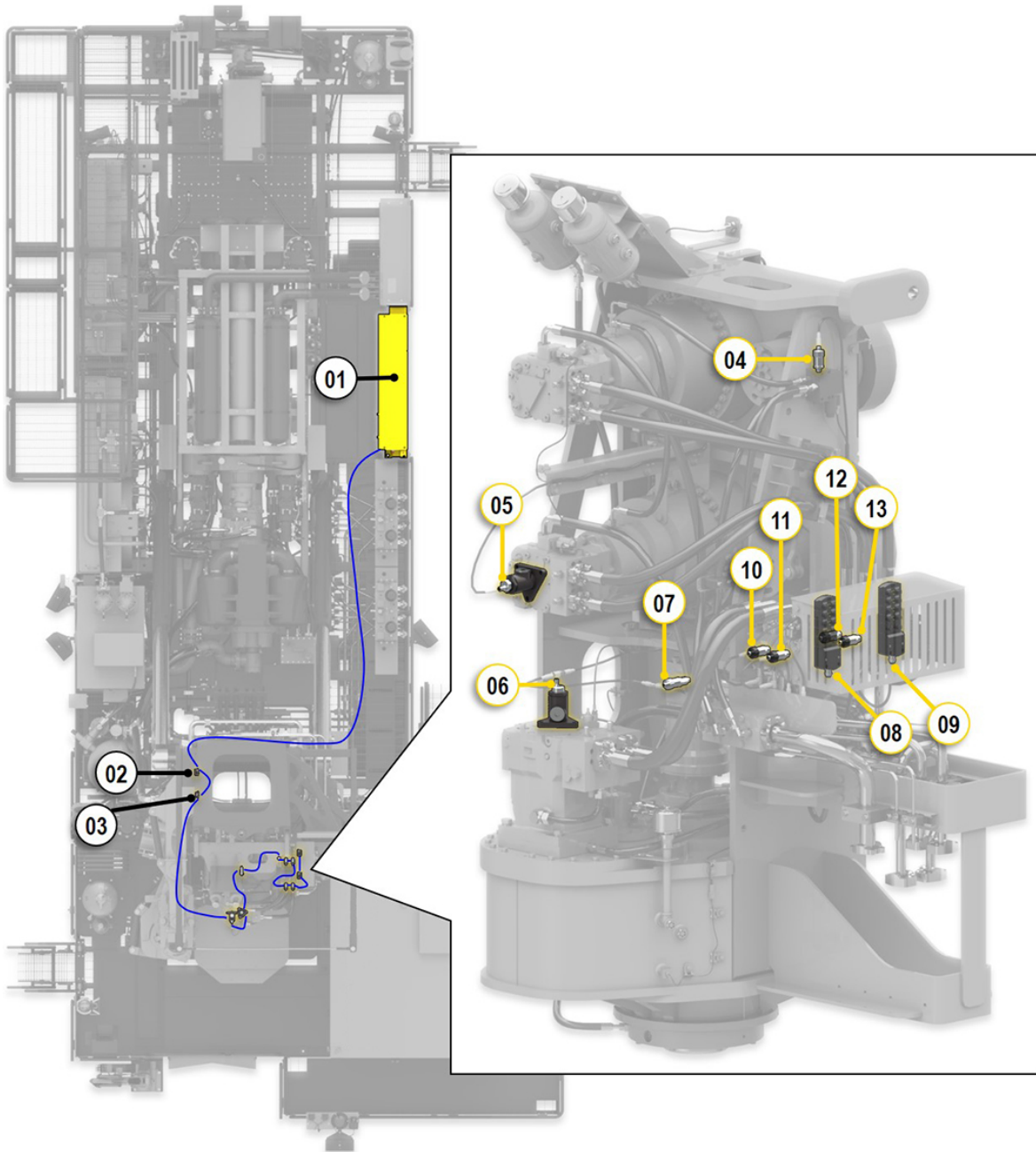
The Mast Network 2 is terminated on the right side of the rotary carriage.

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Figure 7: Mast Network 2



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- | | | |
|--|--|---|
| 01 - Control Cabinet | 07 - TTP_CBA – Bit Air Pressure Transducer | 10 - TTP_CRAD – Carriage Rotary Anti-Drilling (Reverse Direction) Pressure Transducer |
| 02 - IO_MM – Mast Middle I/O Module | 08 - IO_C1 – Carriage I/O Module #1 | 11 - TTP_CRD – Carriage Rotary Drill Pressure Transducer |
| 03 - IN_MIA – Mast Accelerometer/Inclinometer | 09 - IO_C2 – Carriage I/O Module #2 | 12 - TTP_CTPD – Carriage Travel Pulldown (Travel Down) Pressure Transducer |
| 04 - TTP_CTPB – Carriage Travel Park Brake Pressure Transducer | | 13 - TTP_CTH – Carriage Travel Hoist (Travel Up) Pressure Transducer |
| 05 - EN_CT - Carriage Travel Encoder | | |
| 06 - EN_CR – Carriage Rotary Encoder | | |

Engine Network & Air Compressor Network

The engine CAN bus (J1939) network is connected to the engine control module and the network of components connected to the engine's perimeter harness. For more information on the diesel engine network, see the included engine manufacturer's documentation.

The air compressor CAN bus (J1939) network is connected to optional components that *may* be equipped with the drill. These include the APU alternator, torque converter, engine alternator, and compressor inlet butterfly valve/linear actuator. See the included electrical schematic, provided with your machine for the exact details.

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Maintenance

Electrical component on the drill, **do not** require any preventative maintenance. All electrical components have been designed to be run until failure.

In the event of a detected electrical component failure, the machine controller will display a notice, warning, or alarm (depending on the severity of the component failure). Replace accordingly.

Note: All electrical component failures *may* not be detected, depending on the exact component and the nature of the malfunction.

NOTICE

*Always obtain specific part numbers from the up-to-date electronic parts manual. If a component is used multiple times on a machine, be sure to indicate the specific position when ordering. The component **may** have a specific node id associated with it (that is pre-programmed, prior to delivery).*

Note: The only component replacement that requires special consideration are the master batteries, located in the battery cabinet. If a battery will no longer hold a charge or can not be charged successfully; it must be replaced. When replaced, it **must** be a with another AGM (absorbent glass mat) style battery. The battery cabinet is not designed to allow the heating, cooling, and off-gassing that occurs with standard lead acid batteries. AGM batteries are completely sealed, and are the *only* acceptable style of battery that can be used in the battery cabinet.

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Components

NOTICE

Electrical components and component placement may vary based on installed options. Always refer to the electronic parts manual and electrical schematic, included with your drill.

Operator's Cab

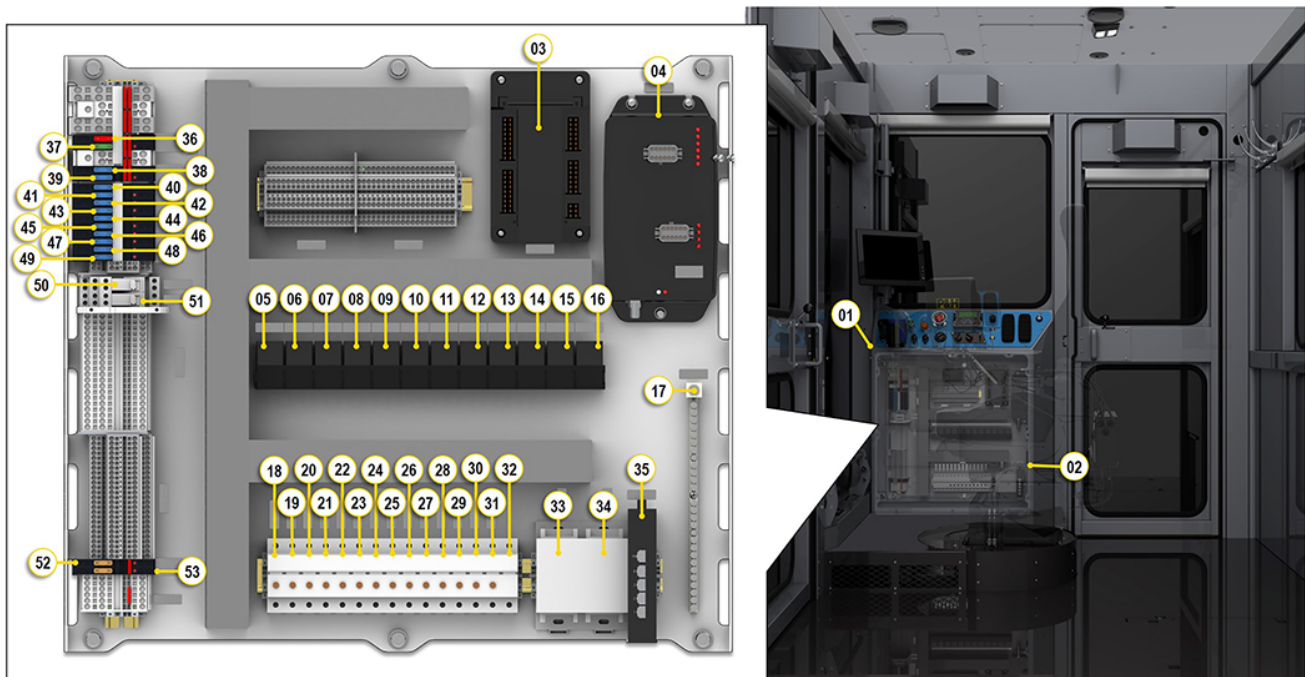
Operator's Cab Electrical Cabinet Assembly

Refer to [Figure 8 : Operator's Cab Electrical Panel](#).

The operator's cab electrical cabinet assembly is located directly underneath the operator's dash.

It contains all the fuses and relays for the in-cab electrical components. Additional components include the cab I/O module (03, [Figure 8](#)), cab power output module (04, [Figure 8](#)), and operator cab Ethernet switch (35, [Figure 8](#)).

Figure 8: Operator's Cab Electrical Panel



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01 - ABU_CAB - Operator's Cab Alarm Buzzer	19 - FU_IOX20 – I/O Module X20 Outputs Fuse	37 - FU_CMR – Mine Radio Power Fuse
02 - FU_CPOM – Cab Power Out	20 - FU_IOX21 – I/O Module X21 Outputs Fuse	38 - FU_OCR – Operator's Cab Radio Power Fuse
03 - IO_MC – Cab I/O Module	21 - FU_24S – 24VDC Spare Fuse	39 - FU_SPB1 – Spare Fuse
04 - IO_CPOM – Cab Power Output Module	22 - FU_HPR	40 - FU_WDL – Wiper Motor (Front Door) Lower Speed Fuse
05 - CR_CCCHS – Ceiling Condenser Hydraulic Solenoid Valve Relay	23 - FU_ACCF – Air Conditioner Control Fuse	41 - FU_WDH – Wiper Motor (Front Door) High Speed Fuse
06 - CR_CCF1 – Ceiling Condenser Fan #1 Relay	24 - FU_CCF1 – Ceiling Condenser Fan #1 Fuse	42 - FU_WFL – Wiper Motor (Front) Low Speed Fuse
07 - CR_CCF2 – Ceiling Condenser Fan #2 Relay	25 - FU_CCF2 – Ceiling Condenser Fan #2 Fuse	43 - FU_WFH – Wiper Motor (Front) High Speed Fuse
08 - CR_FCCHS – Floor Condenser Hydraulic Solenoid Valve Relay	26 - FU_CCH – Ceiling Compressor Hydraulic Valve Fuse	44 - FU_WLL – Wiper Motor (Left) Low Speed Fuse
09 - CR_FCF1 – Floor Condenser Fan #1 Relay	27 - FU_FCF1 – Floor Condenser Fan #1 Fuse	45 - FU_WLH – Wiper Motor (Left) High Speed Fuse
10 - CR_FCF2 – Floor Condenser Fan #2 Relay	28 - FU_FCF2 – Floor Condenser Fan #2 Fuse	46 - FU_WLDL – Wiper Motor (Left Door) Low Speed Fuse
11 - CR_CCL – Ceiling Condenser Low Relay	29 - FU_FCH – Floor Compressor Hydraulic Valve Fuse	47 - FU_WLDH – Wiper Motor (Left Door) High Speed Fuse
12 - CR_FCL – Floor Condenser Low Relay	30 - FU_CB – Ceiling Blower Fuse	48 - FU_WRL – Wiper Motor (Rear) Low Speed Fuse
13 - CR_CCM – Ceiling Condenser Medium Relay	31 - FU_FB – Floor Blower Fuse	49 - FU_WRH – Wiper Motor (Rear) High Speed Fuse
14 - CR_FCM – Floor Condenser Medium Relay	32 - Spare Fuse Holder	50 - CR_KSIGN – Key Switch Ignition Control Relay
15 - CR_CCH – Ceiling Condenser High Relay	33 - DB_24VDC – 24VDC Distribution Block	51 - CR_KSSTRT – Key Switch Engine Start Control Relay
16 - CR_FCH – Floor Condenser High Relay	34 - DB_0VDC – 0VDC Distribution Block	52 - FU_ES – Ethernet/HMI Computer Fuse
17 - GR_CP – Ground bar	35 - ES_OC – Operator Cab Ethernet Switch	53 - FU_GUI – Operator's Touch Screen Fuse
18 - FU_R – Refrigerator Power Fuse	36 - FU_ACC – 12VDC Accessory Receptacle Fuse	

Operator's Cab Interface Panel

Refer to [Figure 9 : Operator's Cab Interface Panel](#).

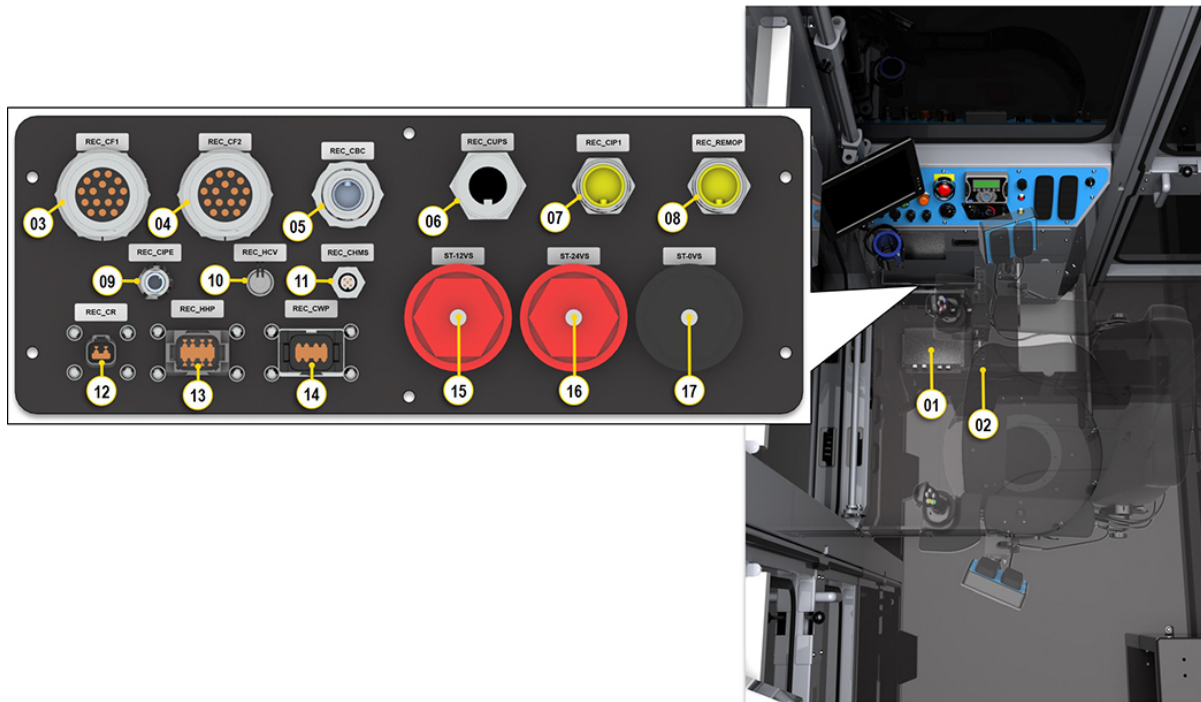
The operator's cab interface panel ([Figure 9](#)) connects power and communications, from the cab to the rest of the machine. It is located directly underneath the operator's cab electrical panel. Additionally, the HMI machine controller ([01, Figure 9](#)) and cab control CAN 12 port distribution block ([02, Figure 9](#)) are located in front of the cab interface panel (beneath the operator's chair footboards).

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Figure 9: Operator's Cab Interface Panel



- | | | |
|--|---|---|
| 01 - HMI - Machine Controller | 07 - REC_CIP1 – Cab Interface Plate Receptacle #1 | 12 - REC_CR – Cab Refrigerator Receptacle |
| 02 - DB_CCC – Cab Control CAN 12 Port Distribution Block | 08 - REC_REMOP – Cab TeleOp Interface Plate Receptacle | 13 - REC_HHP – Heater Hydraulic Proportional Receptacle |
| 03 - REC_CF1 – Cab Floor Receptacle 1 | 09 - REC_CIPE – Cab Interface Plate Ethernet Receptacle | 14 - REC_CWP – Cab Washer Pump Receptacle |
| 04 - REC_CF2 – Cab Floor Receptacle 2 | 10 - REC_HCV – Hawkeye Camera Video Receptacle | 15 - ST-12VS – Cab 12 Volt Supply Stud |
| 05 - REC_CBC – CAN Bus Communications Receptacle | 11 - REC_CHMS – Cab Het Motor Speed Sensor Receptacle | 16 - ST-24VS – Cab 24 Volt Supply Stud |
| 06 - REC_CUPS – Cab UPS Receptacle | | 17 - ST-0VS – Cab 0 Volt Supply Stud |

Operator's Wiper Assemblies

Refer to [Figure 10 : Cab Wiper Motors](#) & [Figure 11 : Cab Washer Fluid Motors](#)

Each upper glass window on the operator's cab has a corresponding 24 volt wiper motor assembly.

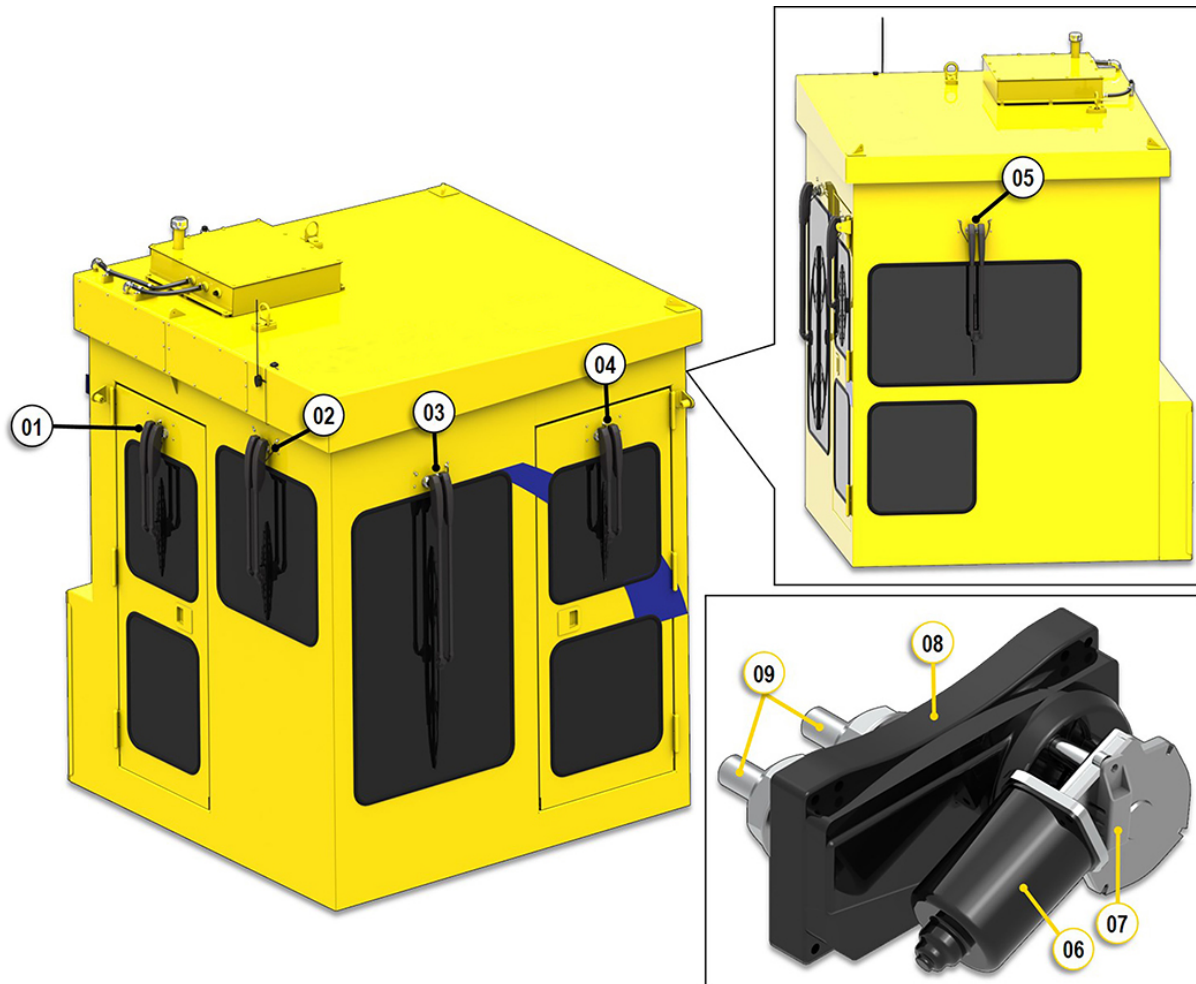
Each wiper motor (01, 02, 03, 04, 05, [Figure 10](#)) utilizes dual output shafts (09, [Figure 10](#)) that are connected to dual wiper arms. The wiper itself is connected by the dual arms to create a pantograph sweep pattern.

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Figure 10: Cab Wiper Motors



01 - MTR_FDW – Front Door Wiper Motor

02 - MTR_FW – Front Wiper Motor

03 - MTR_LW – Left Wiper Motor

04 - MTR_LDW – Left Door Wiper Motor

05 - MTR_RW – Rear Wiper Motor

06 - 24 Volt Wiper Motor

07 - Electrical Harness Connection

08 - Dual Sector Gear Drive

09 - Dual Output Shafts (Pantograph Sweep Pattern)

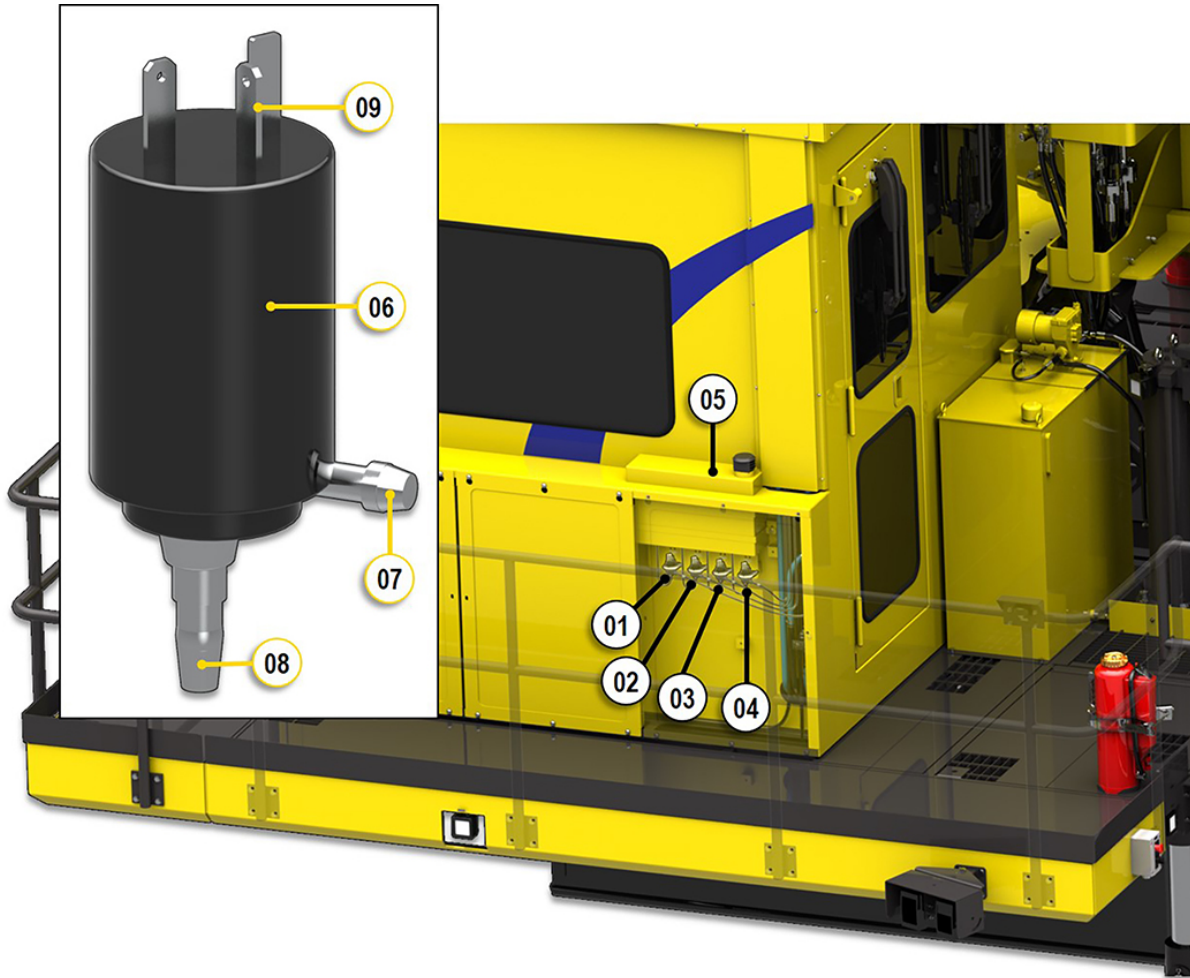
Each wiper motor, utilizes a corresponding 24 volt washer pump motor (01, 02, 03, 04, [Figure 11](#)) to inject washer fluid onto the window. Each pump can provide an average flow rate of 61.74 mL per three seconds at 23.34 PSI (1.61 bar). All four pumps draw from a single washer fluid reservoir (05, [Figure 12](#)).

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Figure 11: Cab Washer Fluid Motors



- 01 - PMP_WSH_F – Washer Pump Front
- 02 - PMP_WSH_L – Washer Pump Left
- 03 - PMP_WSH_LD – Washer Pump Left Door

- 04 - PMP_WSH_R – Washer Pump Rear
- 05 - Window Washer Fluid Reservoir
- 06 - 24 Volt Washer Fluid Pump

- 07 - Pump Outlet (to Wiper Arms)
- 08 - Pump Input (from Fluid Reservoir)
- 09 - Electrical Harness Connection

Operator's Cab Radio

Refer to [Figure 12 : Cab Radio](#).

Note: The radio system is optional. Components may vary, depending on the operating location of the drill.

Note: For further information on radio operation, see the manufacture's included documentation.

A radio head unit (01, [Figure 12](#)) is located in the center of the operator's dash controls. The radio utilizes dual antennas for both satellite (02, [Figure 12](#)) and FM (03, [Figure 12](#)) radio.

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In the ceiling of the cab (**04**, [Figure 12](#)) are four speakers (**05**, [Figure 12](#)), that are connected to the radio's amplifier. **Note:** The radio *may* use a separate amplifier, which is not shown in [Figure 12](#).

Figure 12: Operator's Cab Radio



01 - CTL_R – Radio Head Unit
02 - ANT_SAT – Satellite Radio Antenna

03 - ANT_RADIO – FM Radio Antenna
04 - Operator's Cab Ceiling

05 - Speakers (4)

Operator's Cab Refrigerator

Refer to [Figure 13](#) : Operator's Cab Refrigerator.

A small drawer refrigerator (**02**, [Figure 13](#)) is located in the corner of the cab, shown under the optional trainer's seat (**01**, [Figure 13](#)). The refrigerator allows the operator to store chilled food or beverages, while they operate the drill.

Note: For further information on refrigerator, see the manufacture's included documentation.

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Figure 13: Operator's Cab Refrigerator



01 - Optional Trainer's Seat

02 - REF_OCR – Refrigerator

Deck Mounted Components

The following components are located throughout the deck of the drill.

The drill's deck is physically divided into two sections. Everything forward of the mast is contained on the "front deck", while everything behind the mast is contained on the "rear deck".

Control Cabinet

Refer to [Figure 14 : Control Cabinet - Panel #1](#), [Figure 15 : Control Cabinet - Panel #2](#), [Figure 16 : Control Cabinet - Between Panels](#), [Figure 17 : Control Cabinet Connections](#), [Figure 18 : Control Cabinet Emergency Stop & Reset Switch](#).

The control cabinet is the centrally located repository for the majority of electrical components that are used to control the machine. Additionally the control cabinet serves as the central power distribution point, for all electrical equipment.

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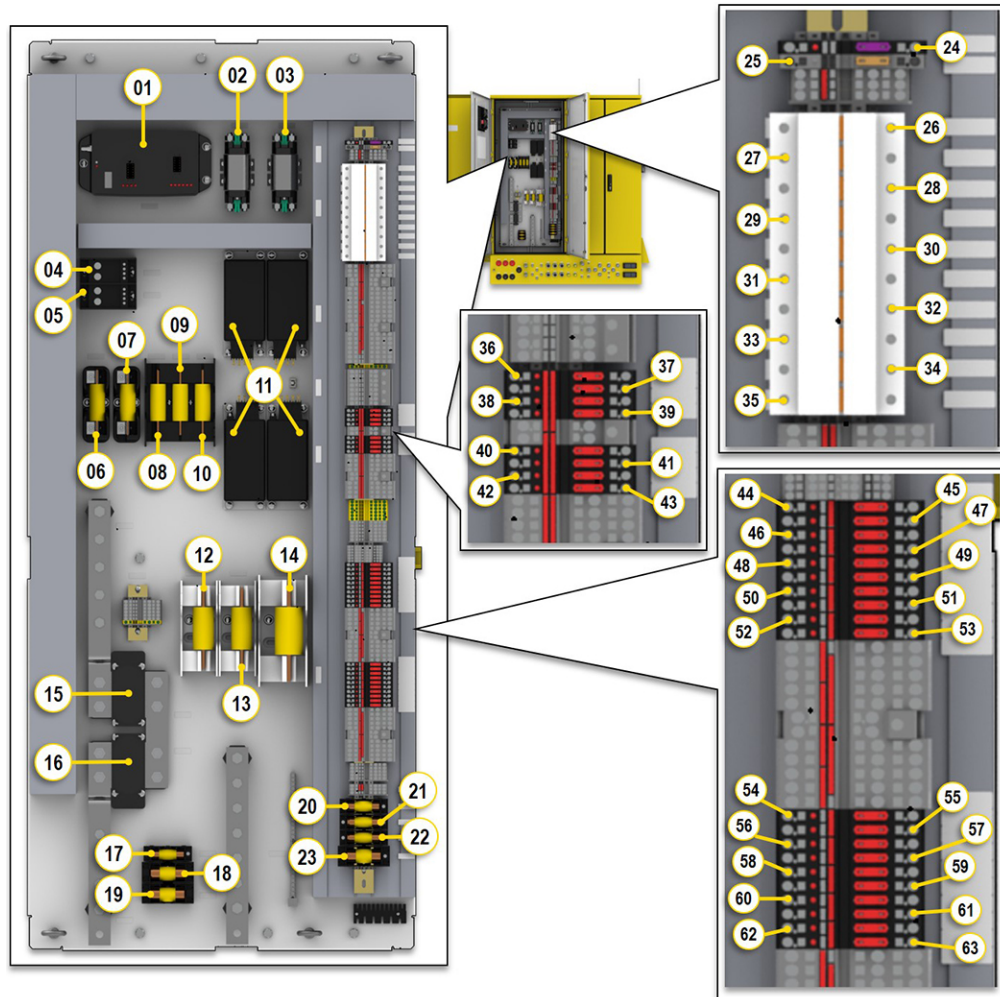
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The cabinet is divided into multiple, distinct zones that are illustrated in *Figure 14* through *Figure 18* .

The front side of the control cabinet contains the Panel #1 assembly (*Figure 14*). A large percentage of the machines fuses are located on this panel. This provide a centralized means of electrical protection for the variety of electrical components located throughout the machine.

Figure 14: Control Cabinet - Panel #1



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01 - IO_CLM – 100 Amp Power Distribution Module	19 - FU_AE – 60 Amp Fuse	41 - FU_CIOB3 – 10 Amp Fuse
02 - CON_AS – 100 Amp Power Relay	20 - FU_CECS1 – 20 Amp Fuse	42 - FU_S3IOB – 10 Amp Fuse
03 - CON_MCC – 100 Amp Power Relay	21 - FU_CECS2 – 20 Amp Fuse	43 - FU_S4IOB – 10 Amp Fuse
04 - DB_MP – 600 Volt AC/DC Terminal Block	22 - FU_DAP1 – 20 Amp Fuse	44 - FU_RPL – 10 Amp Fuse
05 - DB_MN – 600 Volt AC/DC Terminal Block	23 - FU_CWH2 – 60 Amp Fuse	45 - FU_FPL – 10 Amp Fuse
06 - FU_IOBP – 70 Amp Fuse	24 - FU_FB1 – 3 Amp Fuse	46 - FU_RCPL – 10 Amp Fuse
07 - FU_IOBP – 70 Amp Fuse	25 - FU_FB2 – 7.5 Amp Fuse	47 - FU_PLF – 10 Amp Fuse
08 - FU_P – 100 Amp Fuse	26 - FU_DCRL – 8 Amp Fuse	48 - FU_FLF1 – 10 Amp Fuse
09 - FU_AES1 – 100 Amp Fuse	27 - FU_LPS – 30 Amp Fuse	49 - FU_FLF2 – 10 Amp Fuse
10 - FU_AES2 – 100 Amp Fuse	28 - FU_EC – 10 Amp Fuse	50 - FU_BLF1 – 10 Amp Fuse
11 - 24R – 300 Watt DC to DC Converters (x4)	29 - FU_PW – 15 Amp Fuse	51 - FU_BLF2 – 10 Amp Fuse
12 - FU_OCP – 150 Amp Fuse	30 - FU_PH – 10 Amp Fuse	52 - FU_LS1 – 10 Amp Fuse
13 - FU_CWH1 – 150 Amp Fuse	31 - FU_CCIOM – 15 Amp Fuse	53 - FU_LS2 – 10 Amp Fuse
14 - FU_PL – 225 Amp Fuse	32 - FU_CCGC – 15 Amp Fuse	54 - FU_LS3 – 10 Amp Fuse
15 - CON_MCP2 – 1,000 Amp Contactor	33 - FU_ESIG – 8 Amp Fuse	55 - FU_LS4 – 10 Amp Fuse
16 - CON_MCP1 – 1,000 Amp Contactor	34 - FU_S2S5 – 8 Amp Fuse	56 - FU_GLF1 – 10 Amp Fuse
17 - FU_EU – 20 Amp Fuse	35 - FU_S2S1 – 15 Amp Fuse	57 - FU_GLF2 – 10 Amp Fuse
18 - FU_UPS – 60 Amp Fuse	36 - FU_S1IOB – 10 Amp Fuse	58 - FU_GLF3 – 10 Amp Fuse
	37 - FU_ALIOB – 10 Amp Fuse	59 - FU_GLF4 – 10 Amp Fuse
	38 - FU_CIOB – 10 Amp Fuse	60 - FU_O91 – 10 Amp Fuse
	39 - FU_CIOB2 – 10 Amp Fuse	61 - FU_O92 – 10 Amp Fuse
	40 - FU_MCIOB1 – 10 Amp Fuse	62 - FU_O10F1 – 10 Amp Fuse
		63 - FU_O10F2 – 10 Amp Fuse

The rear side of the control cabinet contains the Panel #2 assembly ([Figure 15](#)). This panel contains the majority of individual electrical components that when combined together, form the basis for control on the machine.

The main controller (**06**, [Figure 15](#)) is the primary means of connecting CAN components. It features interchangeable modules that allow for multiple networks worth of CAN components to communicate with the machine controller.

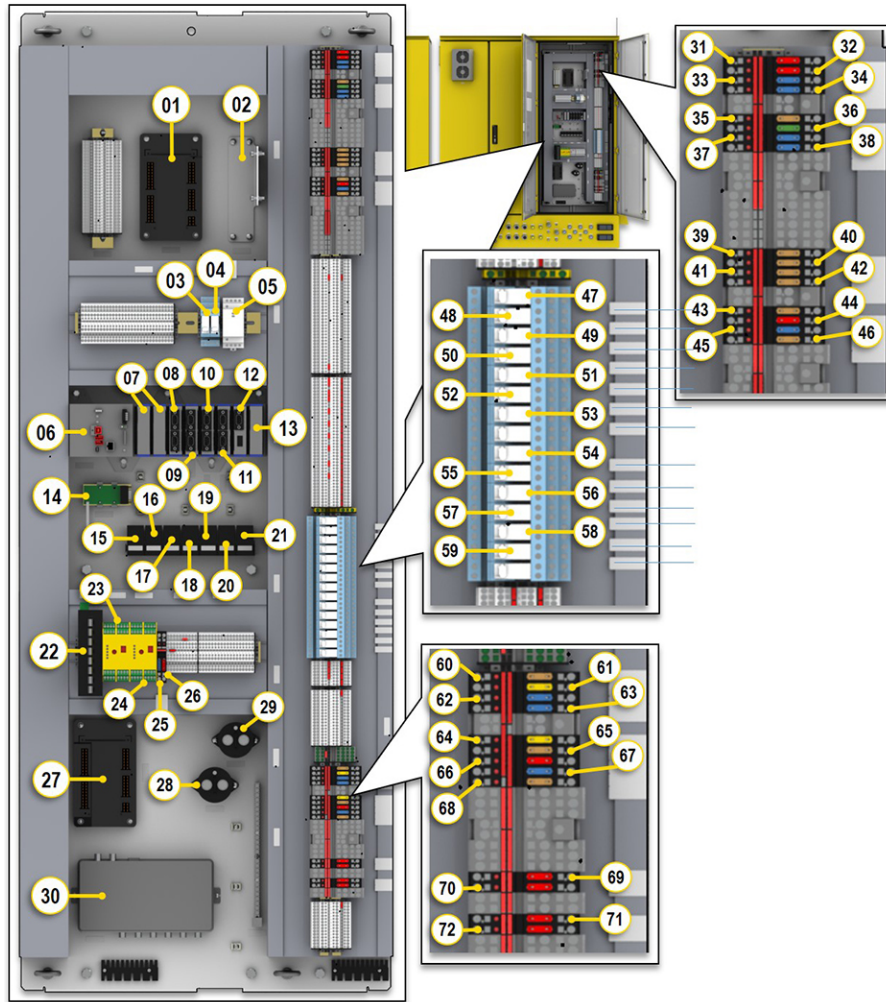
The optional remote propel receiver (**02**, [Figure 15](#)) is also located on the right side wall. It connects to the antenna on the side of the control cabinet.

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Figure 15: Control Cabinet - Panel #2



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01 - IO_CCM – Control Cabinet I/O Module	21 - CR_PH – Propel Horn Relay	46 - FU_FPDP – 7.5 Amp Fuse
02 - RP_RECVR – Optional Remote Propel Receiver Location	22 - ES_CC – 8 Port Ethernet Switch	47 - CR_ENGS – Relay
03 - CR_DCL – Relay	23 - CR_ESTOP – Emergency Stop Relay	48 - CR_PMS – Relay
04 - CR_DCR – Relay	24 - CR_RMS – Relay	49 - CR_ESR – Relay
05 - CON_FPO – 25 Amp Modular Contactor	25 - FU_CBRCS – 15 Amp Fuse	50 - CR – Relay
06 - C_MC – Main Controller	26 - FU_CBRCC – 10 Amp Fuse	51 - CR_RST – Relay
07 - VCU Blank Module (x2)	27 - IO_CCMA – Control Cabinet I/O Module	52 - CR_MCP1 – Relay
08 - IO_CCM1S3 – VCU Two Port CAN Module	28 - CON_CWH2 – 200 Amp DC Contactor	53 - CR_MCP2 – Relay
09 - IO_CCM2S4 – VCU Two Port CAN Module	29 - CON_CWH1 – 200 Amp DC Contactor	54 - CR_AS – Relay
10 - IO_CCM3S5 – VCU Two Port CAN Module	30 - VC_CU – ASL 360 Control Unit	55 - CR_MC – Relay
11 - IO_CCM4S6 – VCU Two Port CAN Module	31 - FU_CPS – 10 Amp Fuse	56 - CR_MESR1 – Relay
12 - IO_CCM5S7 – VCU Two Port CAN Module	32 - FU_DAP2 – 10 Amp Fuse	57 - CR_MESR2 – Relay
13 - VCU Blank Module	33 - FU_BBEC – 15 Amp Fuse	58 - CR_RES1 – Relay
14 - ID_KEY – Machine ID Key	34 - FU_CAIV – 15 Amp Fuse	59 - CR_RES2 – Relay
15 - CR_CPS – Control Panel Supply Relay	35 - FU_ESIG – 7.5 Amp Fuse	60 - FU_WLCR1 – 5 Amp Fuse
16 - CR_P – Pre-lube Relay	36 - FU_S1US – 30 Amp Fuse	61 - FU_WLPR – 20 Amp Fuse
17 - CR_S1 – Starter #1 Start Relay	37 - FU_CUPS – 15 Amp Fuse	62 - FU_CCLTH – 15 Amp Fuse
18 - CR_S2 – Starter #2 Start Relay	38 - FU_RPR – 15 Amp Fuse	63 - FU_CCX2IO – 15 Amp Fuse
19 - CR_MPWL – Mast Platform Work Lights Relay	39 - FU_CBCS – 7.5 Amp Fuse	64 - FU_MPWL – 20 Amp Fuse
20 - CR_WLC1 – Work Light Control #1 Relay	40 - FU_CBJS – 7.5 Amp Fuse	65 - FU_CTCC – 5 Amp Fuse
	41 - FU_CBOS – 7.5 Amp Fuse	66 - FU_HPACPRV – 10 Amp Fuse
	42 - FU_CBMS – 7.5 Amp Fuse	67 - FU_BH – 15 Amp Fuse
	43 - FU_CBRS – 7.5 Amp Fuse	68 - FU_MB – 5 Amp Fuse
	44 - FU_VES – 3 Amp Fuse	69 - FU_WLPR1 – 10 Amp Fuse
	45 - FU_UPSS3 – 15 Amp Fuse	70 - FU_WLPR2 – 10 Amp Fuse
		71 - FU_MSWL1 – 10 Amp Fuse
		72 - FU_MSWL2 – 10 Amp Fuse

Two separate brackets are located in between the Panel #1 and Panel #2 ([Figure 16](#)).

The power buffer modules (01, [Figure 16](#)) is located on the upper bracket.

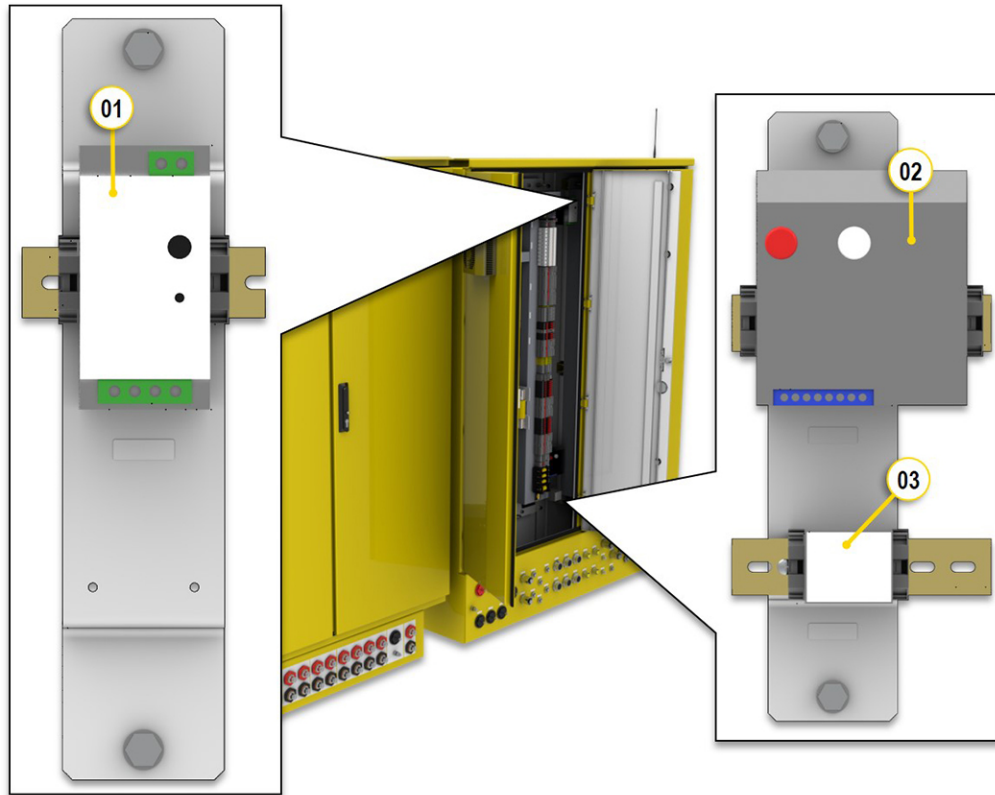
A thermostat (02, [Figure 16](#)) and storage drawer (03, [Figure 16](#)) are located on the lower bracket.

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Figure 16: Control Cabinet - Between Panels



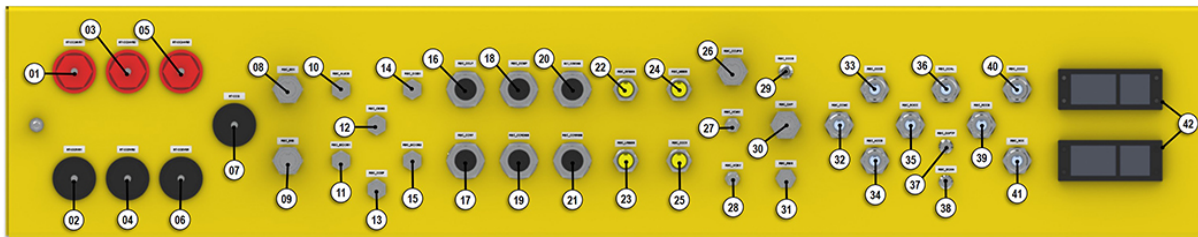
01 - 40 Amp 24VDC Power Buffer Module

02 - DV_CCTC – Bimetalllic Thermostat

03 - STR_BIN – DIN Rail Mounted Storage Drawer

All main control cabinet connections are located on the bottom of the cabinet ([Figure 17](#)). All connections are protected from the deck by a solid walkway plate (as opposed to the walkway grate material used elsewhere).

Figure 17: Control Cabinet Connections



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01 - ST-CC24VS1	15 - REC_MCIQB2	29 - REC_CCCE
02 - ST-CC0VS1	16 - REC_CCLF	30 - REC_DAP
03 - ST-CC24VS2	17 - REC_CCRF	31 - REC_RMS
04 - ST-CC0VS2	18 - REC_CCMP	32 - REC_CCMC
05 - ST-CC24VS3	19 - REC_CCRDBB	33 - REC_CCCB
06 - ST-CC0VS3	20 - REC_CCRRDBB	34 - REC_ACCB
07 - ST-CCG	21 - REC_CCRRBB	35 - REC_ROCC
08 - REC_ES1	22 - REC_RFBES	36 - REC_CCAL
09 - REC_ES2	23 - REC_LRBES	37 - REC_DAPTP
10 - REC_ALIOB	24 - REC_MBES	38 - REC_ECAN
11 - REC_MCIQB1	25 - REC_CCC1	39 - REC_RCCB
12 - REC_CIOB2	26 - REC_CCUPS	40 - REC_CCCC
13 - REC_CCEP	27 - REC_VCMV	41 - REC_SCC
14 - REC_CIOB1	28 - REC_VCBV	42 - Cable Entry Frames (x2)

An emergency stop button (**05, Figure 18**) is located on the rear of the control cabinet. When depressed it will immediately stop the machine and set the drill's parking brakes. When depressed, the switch latches closed. After whatever event that caused the need for an emergency stop has been remedied, the switch must be manually pulled out and rotated, to be ready for use again.

The emergency stop system reset button (**06, Figure 18**) is used to reset the machine after it has been stopped by means of any of the emergency stop buttons. After the particular emergency stop button, that triggered the shut down is reset, the system reset button is depressed to allow the drill to be restarted.

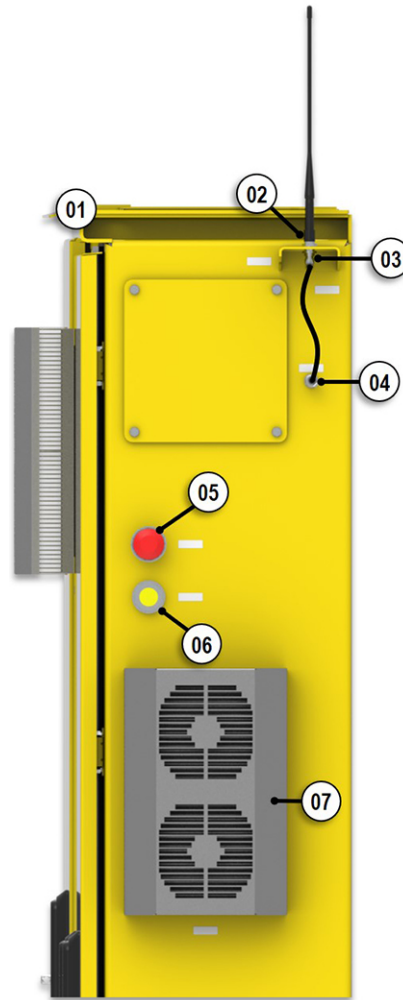
The antenna (**02, Figure 18**) for the *optional* remote propel transmitter is located on the rear top corner of the control cabinet.

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Figure 18: Control Cabinet Emergency Stop & Reset Switch



01 - Control Cabinet (as seen from the Rear Side)

02 - ANT_RPE – Remote Propel External Antenna

03 - REC_RAB2 – Radio Antenna Bulkhead #2 Receptacle

04 - REC_RAB1 – Radio Antenna Bulkhead #1 Receptacle

05 - PB_MECC – Emergency Stop Button

06 - PB_SR – System Reset Push Button

07 - HTR_CCHC2 – Control Cabinet Thermoelectric Heater/Cooler #2

Battery Cabinet

Refer to [Figure 19 : Battery Cabinet](#), [Figure 20 : Battery Cabinet Connections](#), and [Figure 21 : Battery Cabinet Lockouts and Charging Port](#).

The battery cabinet is located just in front of the control cabinet (on the right side of the machine). It contains the six master batteries (01, 02, 04, 05, 06, & 07, [Figure 19](#)) that are used to power the 24 volt system.

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The batteries are used to start the control system and the diesel engine. When the engine is off, power for the lights, and all other electrical components are being drawn from the battery cabinet. Once the diesel engine is running the alternator generates the electrical power used by the machine. The alternator is also used to maintain a constant charge on the batteries.

The battery cabinet contains six heavy duty, 8D sized 12 volt AGM batteries. Each shelf (top and bottom) is arranged in a series configuration, so both batteries together generate 24 volts.

Figure 19: Battery Cabinet



01 - Master Battery #1

02 - Master Battery #2

03 - Battery Cabinet
Thermoelectric Heater/
Cooler

04 - Master Battery #3

05 - Master Battery #4

06 - Master Battery #5

07 - Master Battery #6

08 - Bimetallic Thermostat

NOTICE

The battery cabinet is designed **only** for AGM (absorbed glass mat) batteries. **Never** replace an AGM battery, with a standard lead acid battery.

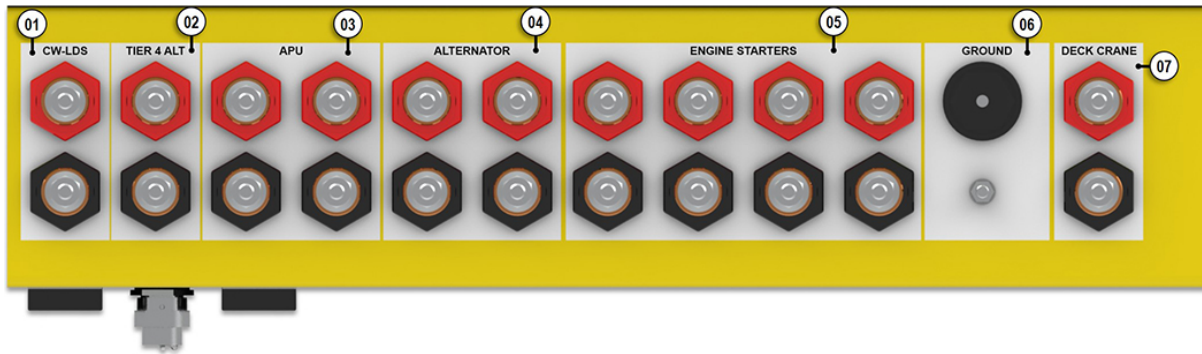
All battery cabinet connections are located on the bottom of the cabinet ([Figure 20](#)). All connections are protected from the deck by a solid walkway plate (as opposed to the walkway grate material used elsewhere).

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Figure 20: Battery Cabinet Connections



01 - CW-LDS

02 - Tier 4 Alt.

03 - Auxiliary Power Unit (x2)

04 - Alternator (x2)

05 - Engine Starters (x4)

06 - Ground

07 - Deck Crane

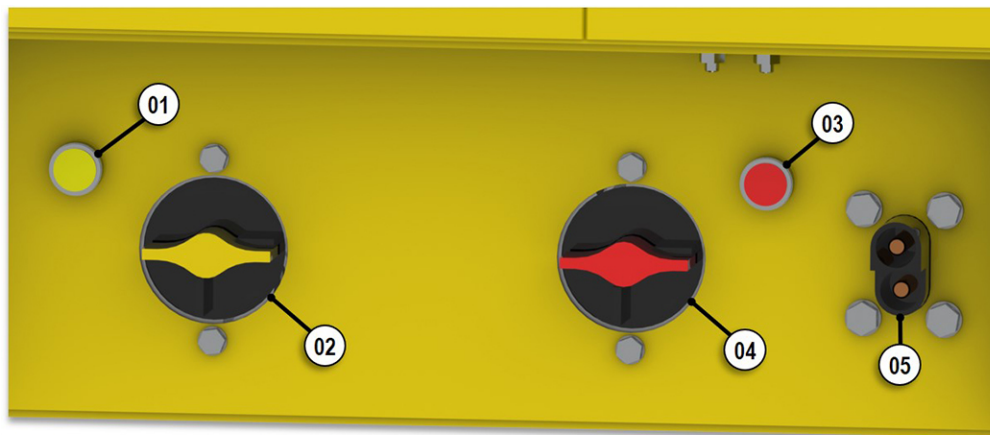
Two disconnects switches are located on the left side of the machine. They are intended to be used during maintenance or when the machine is off for more than one hour.

The starter disconnect switch (01, [Figure 21](#)) prevents the diesel engine from being started. When starter has power to it, the starter power light (02, [Figure 21](#)) will be illuminated yellow.

The battery disconnect switch (03, [Figure 21](#)) removes electrical power from the machine. When battery power is available, the main battery power light (04, [Figure 21](#)) will be illuminated red.

In the event of a dead battery, the machine's batteries can be recharged via the battery charging socket (05, [Figure 21](#)).

Figure 21: Battery Cabinet Lockouts and Charging Port



01 - LT_SP - Starter Power Light

02 - DS_SDS - Starter Disconnect Switch

03 - LT_PWR - Main Battery Power Light

04 - DS_BDS - Battery Disconnect Switch

05 - REC_JS - Battery Charging Socket

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Video Cameras

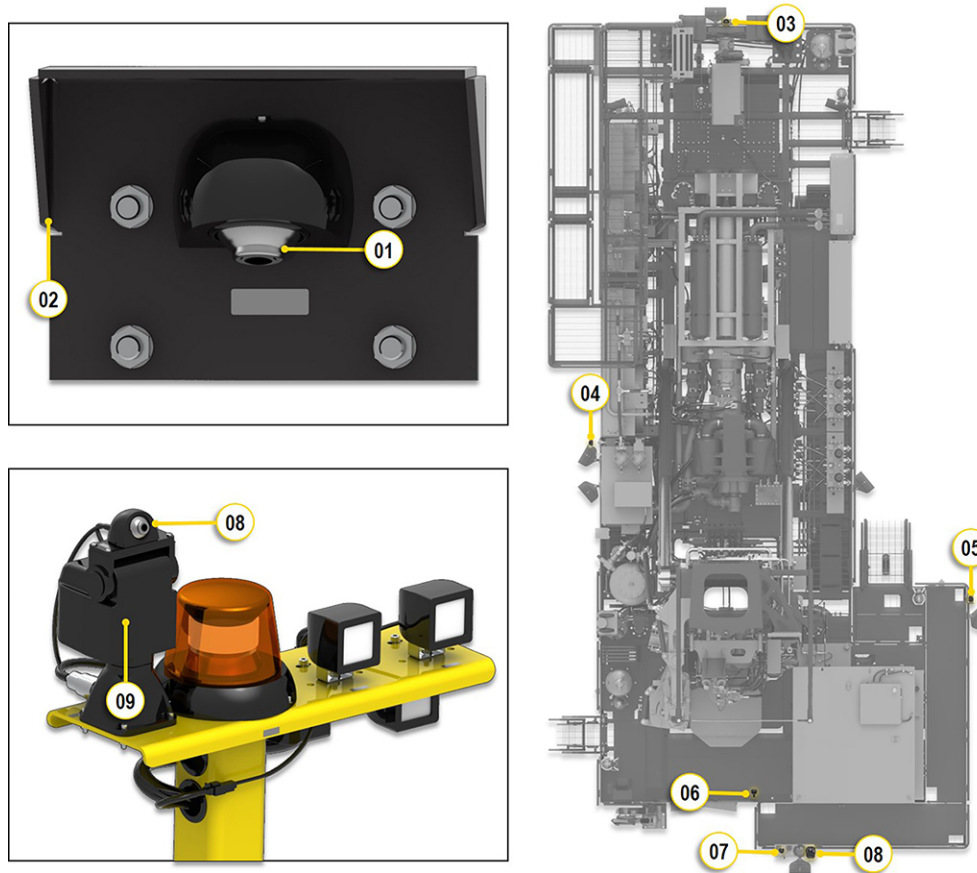
Refer to **Figure 22 : Video Cameras**.

The drill is equipped with two standard cameras. The bit view (**06, Figure 22**) camera and mast view (**08, Figure 22**) camera are standard equipment. The bit view is a fixed mount camera, it only displays video of the drilling operation, as seen from under the deck.

The mast view camera (**08, Figure 22**) is unique in that it is mounted on a 360° pan and tilt platform (**09, Figure 22**). This allows the operator to position the camera's focus, exactly where they dictate. This is especially useful when attempting to inspect the mast, from inside the operator's cab.

Figure 22 also show four additional *optional* cameras placed at the corners of the machine. The front (**03, Figure 22**), right (**05, Figure 22**), left (**04, Figure 22**) and rear (**07, Figure 22**) are standard, fixed mount cameras. They display video from the machine railings, outward. A camera mounting bracket (**02, Figure 22**) also doubles as a protective shroud.

Figure 22: Video Cameras



01 - Camera (typical)

02 - Mounting Bracket / Protective Shroud

03 - Optional VC_FV – Front View Video Camera

04 - Optional VC_LV – Left View Video Camera

05 - Optional VC_RV – Right View Video Camera

06 - VC_BV – Bit View Video Camera

07 - Optional VC_REARV – Rear View Video Camera

08 - VC_MV – Mast View Video Camera

09 - WV_MVPTU – Mast View 360° Pan/Tilt Unit

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Lubrication Electrical Enclosure

Refer to [Figure 23](#) : Lubrication Electrical Enclosures.

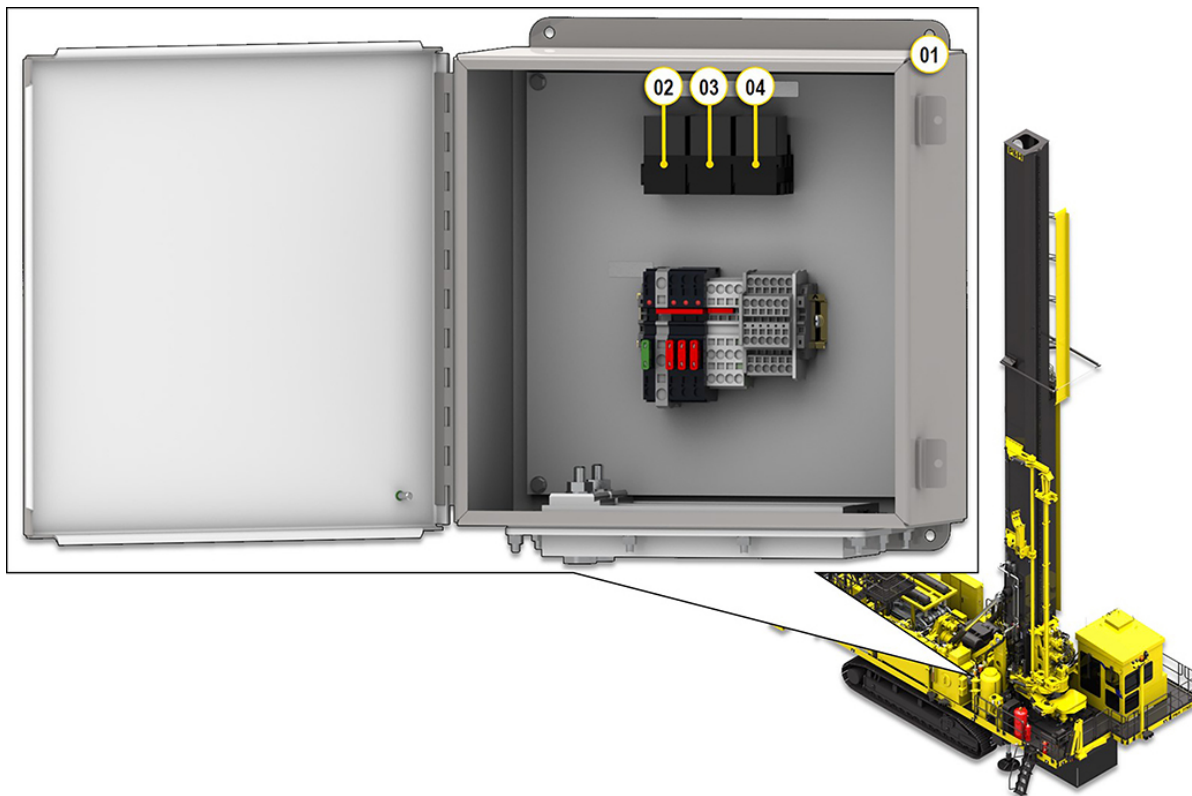
A lubrication electrical enclosure (01, [Figure 23](#)) is mounted on the rearward facing side of the hydraulic oil tank.

The enclosure contains the three primary relays associated with the standard and optional lubrication equipment. This including the Lube MPG Pump Relay (02, [Figure 23](#)), the Lube Bit Pump Relay (03, [Figure 23](#)), and the Lube OG Pump Relay (04, [Figure 23](#)).

If no optional lube features are equipped with the machine, only the open gear lube relay (04, [Figure 23](#)) will be present.

For more information on the lubrication pump and tank, see the Lubrication Specifications and Requirements system manual.

Figure 23: Lubrication Electrical Enclosure



01 - Lubrication Electrical Enclosure

02 - CR_LMP – Lube MPG Pump Relay

03 - CR_LBP – Lube Bit Pump Relay

04 - CR_LOP – Lube OG Pump Relay

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Revisions

Note: The following information is from previous versions of this system manual, but are now only accurate to machines with serial numbers RBD77001 and RBD77002.

CAN Bus Networks

Cab Network

Refer to **Figure 24 : Cab Network**.

Note: The blue cabling shown in **Figure 24**, is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

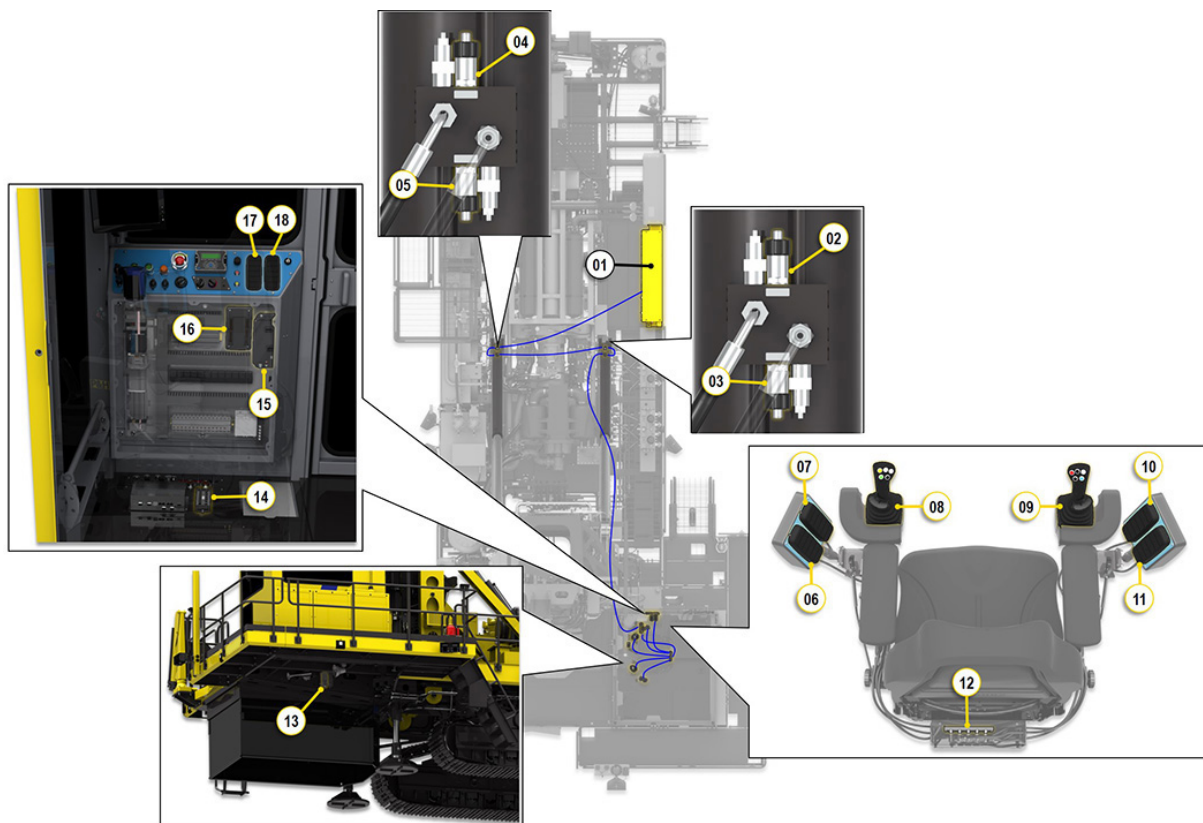
The Cab Network starts at the control cabinet (**01, Figure 24**). The primary CAN trunk line connects the control cabinet, to the mast cylinders, and on to the controls located inside the operator's cab.

Both left and right mast raise/lower cylinders features a base (**03 & 05, Figure 24**) and rod (**04 & 06, Figure 24**) pressure transducers.

All of the operator's keypads (**06, 07, 10, 11, 17, & 18, Figure 24**) and joysticks (**08 & 09, Figure 24**) are connected via branch lines to the distribution block (**12, Figure 24**) located on the back side of the operator's chair.

The Cab Network is terminated at the cab chair 10 port CAN distribution block (**12, Figure 24**).

Figure 24: Cab Network



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01 - Control Cabinet	06 - KP_L1 - Left Keypad #1	13 - IO_RD – Rear Deck I/O Module
02 - PT_MCRB - Right Mast Base Pressure Transducer	07 - KP_L2 – Left Keypad #2	14 - DV_CCC – Cab Control 12 Port CAN Distribution Block
03 - PT_MCRR - Right Mast Rod Pressure Transducer	08 - JS_LH – Left Joystick	15 - IO_CPOM – Cab Power Output Module
04 - PT_MCLB - Left Mast Cylinder Base Pressure Transducer	09 - JS_RH – Right Joystick	16 - IO_MC – Cab I/O Module
05 - PT_MCLR – Left Mast Cylinder Rod Pressure Transducer	10 - KP_R1 – Right Keypad #1	17 - KP_C1 – Dash Keypad #1
	11 - KP_R2 – Right Keypad #2	18 - KP_C2 – Dash Keypad #2
	12 - DB_CCCD – Cab Chair 10 Port CAN Distribution Block	

Chassis Network 1

Refer to [Figure 25](#) : Chassis Network 1.

Note: The blue cabling shown in [Figure 25](#) , is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling used to connect components on the actual machine.

The Chassis Network 1 starts at the control cabinet (**01**, [Figure 25](#)). The primary CAN trunk line connects the control cabinet to both propel motor encoders (**05 & 06**, [Figure 25](#)), and on to the components adjacent to the left side of the power unit.

Branch lines connect the engine and hydraulic radiator RTD modules (**07 & 08**, [Figure 25](#)), as well as the hydraulic tank level transducer (**09**, [Figure 25](#)), both hydraulic tank I/O modules (**10 & 11**, [Figure 25](#)), and main air tank pressure & temperature transducer (**12**, [Figure 25](#)).

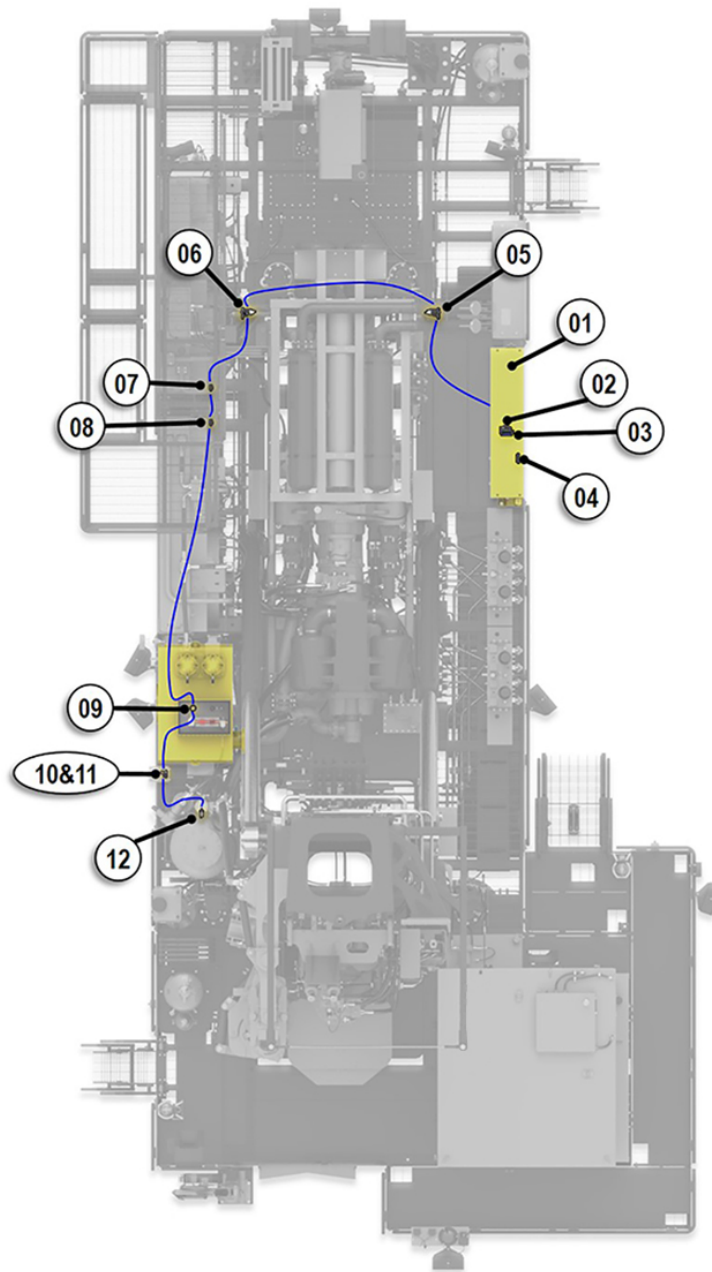
The Chassis Network 1 is terminated on the left side of the machine, just behind the hydraulic oil tank.

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Figure 25: Chassis Network



01 - Control Cabinet

02 - IO_CLM – Chassis Lighting Module

03 - RP_RECVR – Remote Propel Receiver (optional)

04 - IO_CCM – Control Cabinet I/O Module

05 - EN_PR – Right Propel Motor Encoder

06 - EN_RL – Left Propel Motor Encoder

07 - IO_ENG – Engine Radiator 4 RTD CANopen Module

08 - IO_CC – Hydraulic Radiator 4 RTD CANopen Module

09 - LT_HTFL – Hydraulic Tank Level Transducer

10 - IO_HTM1 – Hydraulic Tank I/O Module (Upper)

10&11

12

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11 - IO_HTM2 – Hydraulic Tank
I/O Module (Lower)

12 - TPP_CAOR – Main Air
Tank Pressure &
Temperature Transducer

Chassis Network 2

Refer to [Figure 26](#) : Chassis Network 2.

Note: The blue cabling shown in [Figure 26](#) , is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

The Chassis Network 2 starts at the control cabinet (**01**, [Figure 26](#)). The primary CAN trunk line connects the control cabinet to the terminating resistor.

All of the I/O modules (**02, 03, 04, 07, 08, & 09**, [Figure 26](#)), the auxiliary (**05**, [Figure 26](#)) and fan drive (**06**, [Figure 26](#)) pump pressure transducers, the air compressor inlet pressure transducer (**10**, [Figure 26](#)) are connected via branch lines.

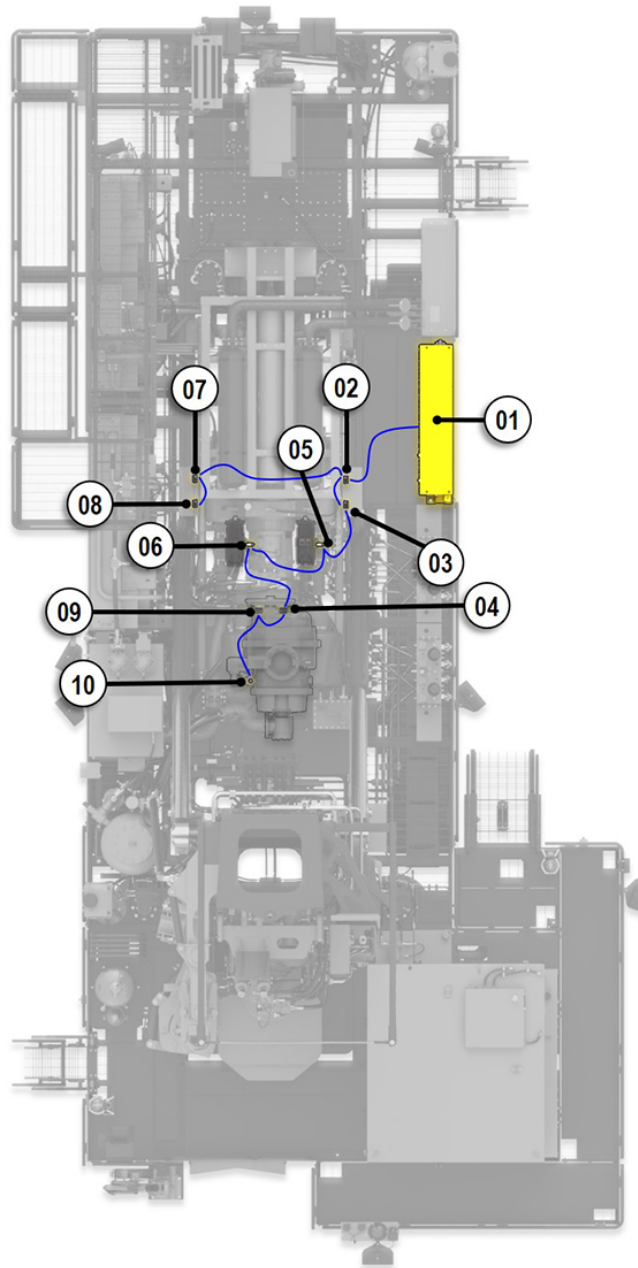
The Chassis Network 2 is terminated on the left side of the machine, near the hydraulic oil tank filters.

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Figure 26: Chassis Network 2



01 - Control Cabinet

02 - IO_PS - Power Skid I/O Module

03 - IO_HD - Hydraulic Diverter I/O Module

04 - IO_REAR - Rear I/O Module

05 - PT_HPA - Auxiliary Hydraulic Pump Load Pressure Transducer

06 - PT_HPC - Fan Drive Hydraulic Pump Load Pressure Transducer

07 - IO_HPS - Hydraulic Pump Sensor I/O Module

08 - IO_HP V - Hydraulic Pump Valve I/O Module

09 - IO_GT - Grease Tank I/O Module

10 - PT_COIP - Air Compressor Inlet Pressure Transducer

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Leveling Network

Refer to **Figure 27 : Leveling Network**.

Note: The blue cabling shown in **Figure 27**, is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

The Leveling Network starts at the control cabinet (**01, Figure 27**). The primary CAN trunk line connects the control cabinet to each individual leveling jack manifolds.

The front I/O module (**06, Figure 27**), fuel tank level transducer (**07, Figure 27**), water tank level transducer (**17, Figure 27**), leveling inclinometer (**16, Figure 27**), and all four main pump pressure transducers (**12, 13, 14, & 15, Figure 27**) are all connected via branch lines to the leveling network.

Each leveling jack has a corresponding extend/retract valve (**02, 08, 18, & 22, Figure 27**), a load pressure transducer (**03, 09, 19, & 23, Figure 27**), a demand pressure transducer (**04, 10, 20, & 24, Figure 27**), and a linear position transducer (**05, 11, 21, & 25, Figure 27**) that relay information to the machine controller.

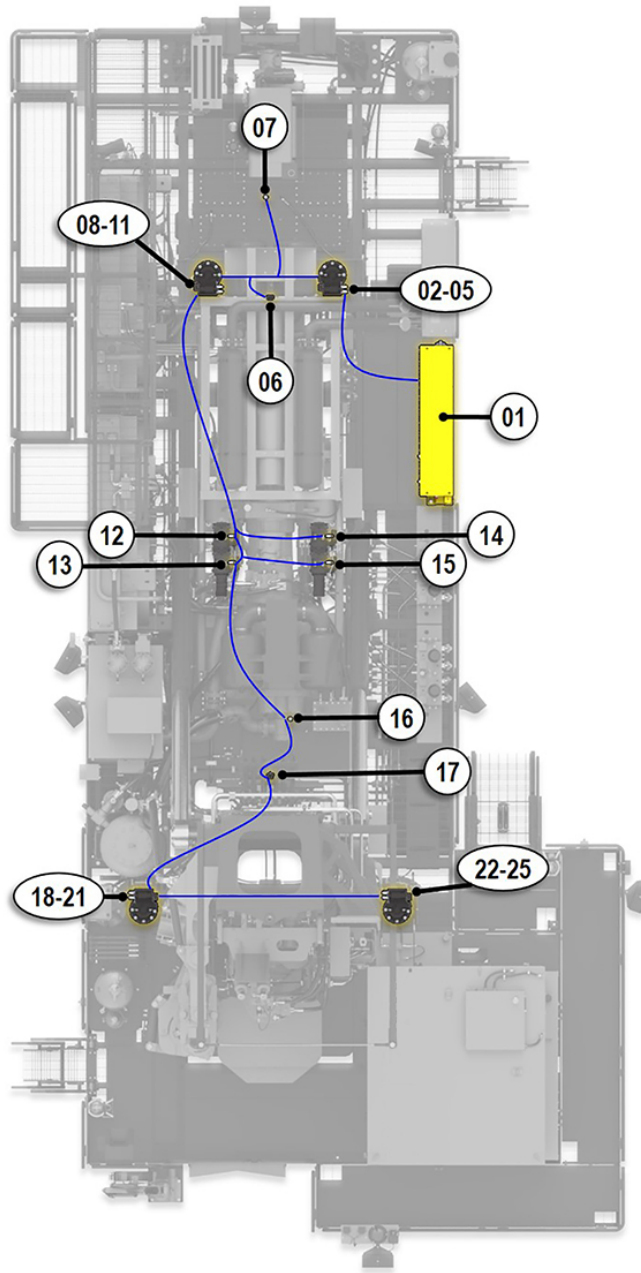
The Leveling Network is terminated at the right rear leveling jack manifold.

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Figure 27: Leveling Network



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01 - Control Cabinet	10 - PT_LJLFD – Leveling Jack Left Front Demand Pressure Transducer	18 - SV_LJLR - Leveling Jack Left Rear Extend/Retract Valve
02 - SV_LJRF – Leveling Jack Right Front Extend/Retract Valve	11 - ZT_LJLF - Leveling Jack Left Front Linear Position Transducer	19 - PT_LJLRL - Leveling Jack Left Rear Load Pressure Transducer
03 - PT_LJRFL – Leveling Jack Right Front Load Pressure Transducer	12 - PT_HPLTR - Left Main Pump Reverse Pressure Transducer	20 - PT_LJLRD - Leveling Jack Left Rear Demand Pressure Transducer
04 - PT_LJRFD – Leveling Jack Right Front Demand Pressure Transducer	13 - PT_HPLTF - Left Main Pump Forward Pressure Transducer	21 - ZT_LJLR - Leveling Jack Left Rear Linear Position Transducer
05 - ZT_LJRF – Leveling Jack Right Front Linear Position Transducer	14 - PT_HPRRF - Right Main Pump Forward Pressure Transducer	22 - SV_LJRR - Leveling Jack Right Rear Extend/Retract Valve
06 - IO_FRONT - Front I/O Module	15 - PT_HPRRR - Right Main Pump Reverse Pressure Transducer	23 - PT_LJRRL – Leveling Jack Right Rear Load Pressure Transducer
07 - LT_EFTL – Engine Fuel Tank Level Transducer	16 - IN_LEV - Leveling Inclinometer	24 - PT_LJRRD – Leveling Jack Right Rear Demand Pressure Transducer
08 - SV_LJLF - Leveling Jack Left Front Extend/Retract Valve	17 - LT_DCWTL - Water Tank Level Transducer	25 - ZT_LJRR - Leveling Jack Right Rear Linear Position Transducer
09 - PT_LJLFL – Leveling Jack Left Front Load Pressure Transducer		

Mast Network 1

Refer to [Figure 28 : Mast Network 1](#).

Note: The blue cabling shown in [Figure 28](#), is purely for illustrative purposes to show the interconnection of components; not to show a specific/exact routing of cabling, used to connect components on the actual machine.

The Mast Network 1 starts at the control cabinet (01, [Figure 28](#)). The primary CAN trunk line connects the control cabinet, around the A-frame, to the mast. The trunk lines wraps around the mast from the left side to the right side.

All five valve banks utilize a load pressure transducer (05, 10, 15, 24, 26, [Figure 28](#)) and a function proportional valve (06, 11, 16, 23, 25, [Figure 28](#)).

The pipe carousel (12, [Figure 28](#)), breakout wrench (13, [Figure 28](#)), slide wrench (17, [Figure 28](#)), bit basket (18, [Figure 28](#)), and bit carousel (19, [Figure 28](#)) all utilize linear position transducers, that provide real-time positioning feedback to the machine controller. Additional positioning information is provided by the rotary encoders on the pipe carousel (14, [Figure 28](#)) and bit carousel (20, [Figure 28](#)) hydraulic motors.

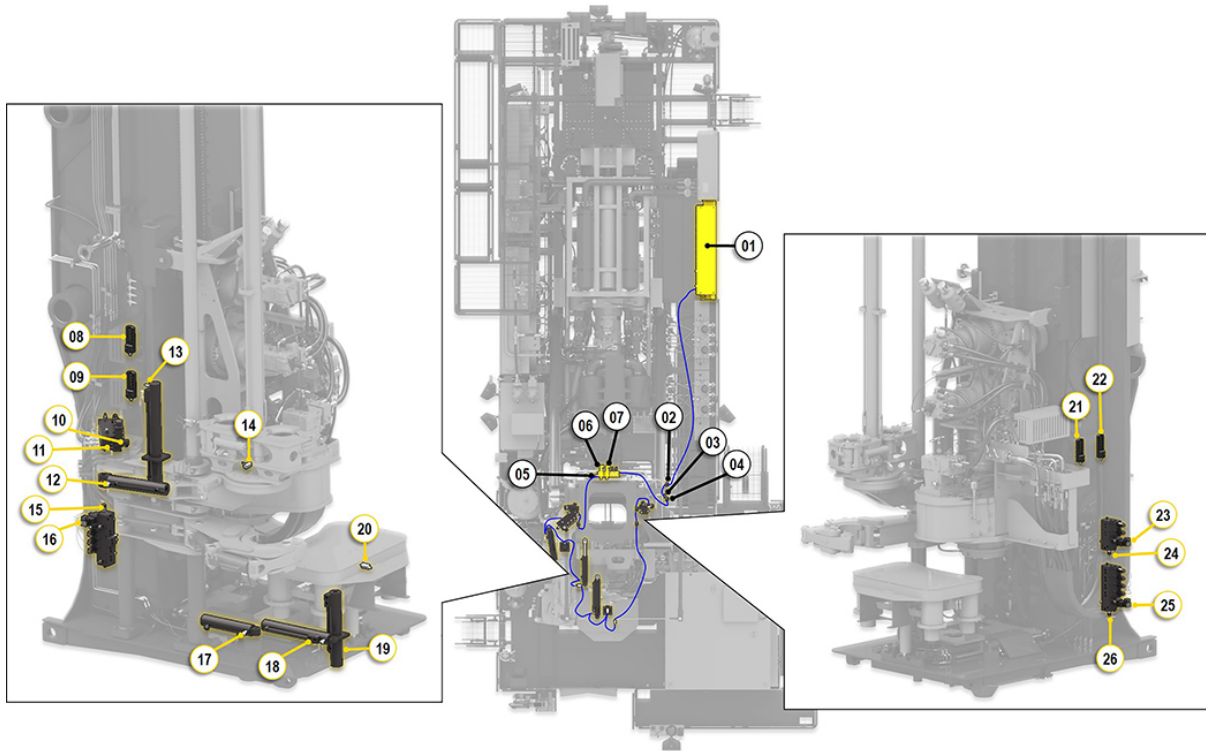
The Mast Network 1 is terminated on the right side of the rotary carriage.

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Figure 28: Mast Network 1



- | | | |
|---|--|---|
| 01 - Control Cabinet | 10 - PT_PCFL – Pipe Carousel Load Pressure Transducer (on VB2) | 17 - ZT_PSWALP – Slide Wrench Linear Position Transducer |
| 02 - IO_AFIOM2 – A-Frame I/O Module #2 | 11 - SV_PCFP – Pipe Carousel Function Proportional Valve (on VB2) | 18 - ZT_BCER – Bit Basket Extend/Retract Linear Position Transducer |
| 03 - IN_MAFAI – Mast A-Frame Accelerometer/Inclinometer | 12 - ZT_PCLP – Pipe Carousel Linear Positioner Transducer | 19 - ZT_BCRL - Bit Carousel Raise/Lower Linear Position Transducer |
| 04 - IO_AFIOM1 – A-Frame I/O Module #1 | 13 - ZT_PBWRL – Breakout Wrench Raise/Lower Linear Position Transducer | 20 - EN_BCI – Bit Carousel Index Encoder |
| 05 - PT_MFL – Mast Function Load Pressure Transducer (on VB1) | 14 - EN_PC – Pipe Carousel Encoder | 21 - IO_MLRS2 – Mast Lower Right Side I/O Module #2 |
| 06 - SV_MRL – Mast Raise/Lower Function Proportional Valve (on VB1) | 15 - PT_PBWL – Breakout Wrench Load Pressure Transducer (on VB3) | 22 - IO_MLRS1 – Mast Lower Right Side I/O Module #1 |
| 07 - SV_MFB – Mast Valve Bank Function Proportional Valve | 16 - SV_PBWFP – Breakout Wrench Function Proportional Valve (on VB3) | 23 - SV_BCFP - Bit Carousel Function Proportional Valve (on VB5) |
| 08 - IO_MLLS2 – Mast Lower Right Side I/O Module #2 | | 24 - PT_BCL - Bit Carousel Load Pressure Transducer (on VB5) |
| 09 - IO_MLLS1 – Mast Lower Right Side I/O Module #1 | | |

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25 - SV_BPHFP - Bit/Pipe Handling Function Proportional Valve (on VB4)

26 - PT_BPHFL - Bit/Pipe Handling Function Load Pressure Transducer (on VB4)

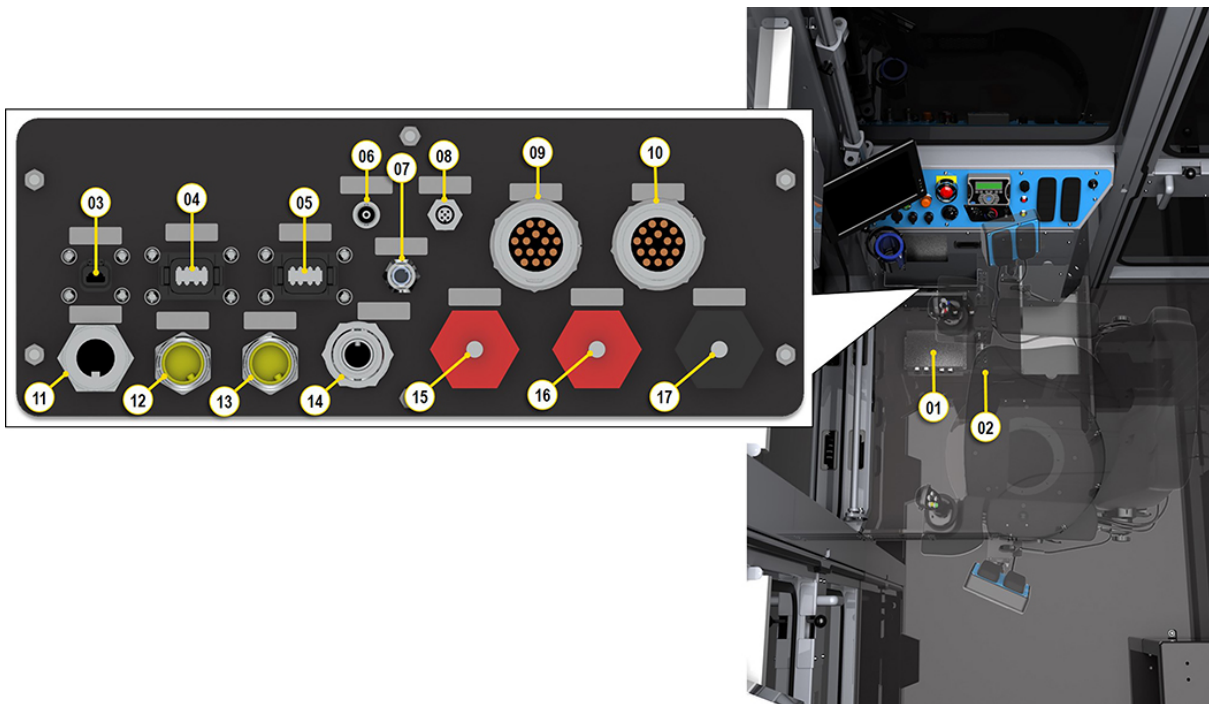
Operator's Cab

Operator's Cab Interface Panel

Refer to [Figure 29](#) : Operator's Cab Interface Panel.

The operator's cab interface panel ([Figure 29](#)) connects power and communications, from the cab to the rest of the machine. It is located directly underneath the operator's cab electrical panel. Additionally, the HMI machine controller ([01, Figure 29](#)) and cab control CAN 12 port distribution block ([02, Figure 29](#)) are located in front of the cab interface panel (beneath the operator's chair footboards).

Figure 29: Operator's Cab Interface Panel



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01 - HMI - Machine Controller
 02 - DB_CCC – Cab Control CAN 12 Port Distribution Block
 03 - REC_CR – Cab Refrigerator Receptacle
 04 - REC_CWP – Cab Washer Pump Receptacle
 05 - REC_HHP – Heater Hydraulic Proportional Receptacle
 06 - REC_HCV – Hawkeye Camera Video Receptacle

07 - REC_CPIPE – Cab Interface Plate Ethernet Receptacle
 08 - REC_CHMS – Cab Het Motor Speed Sensor Receptacle
 09 - REC_CF1 – Cab Floor Receptacle 1
 10 - REC_CF2 – Cab Floor Receptacle 2
 11 - REC_CUPS – Cab UPS Receptacle
 12 - REC_CIP1 – Cab Interface Plate Receptacle #1

13 - REC_REMOP – Cab TeleOp Interface Plate Receptacle
 14 - REC_CBC – CAN Bus Communications Receptacle
 15 - ST-12VS – Cab 12 Volt Supply Stud
 16 - ST-24VS – Cab 24 Volt Supply Stud
 17 - ST-0VS – Cab 0 Volt Supply Stud

Deck Mounted Components

Control Cabinet

Refer to [Figure 30](#) : Control Cabinet - Right Side, [Figure 31](#) : Control Cabinet - Right Side Wall, [Figure 32](#) : Control Cabinet - Left Side 1, [Figure 33](#) : Control Cabinet - Left Side 2, [Figure 34](#) : Control Cabinet - Left Side Wall, [Figure 35](#) : Control Cabinet Connections, [Figure 36](#) : Control Cabinet Emergency Stop & Reset Switch, [Figure 37](#) : Control Cabinet Lockouts & Charging Port.

The control cabinet is the centrally located repository for the majority of electrical components that are used to control the machine. Additionally the control cabinet serves as the central power distribution point, for all electrical equipment.

The cabinet is divided into multiple, distinct zones that are illustrated in [Figure 30](#) through [Figure 37](#) .

The right side of the control cabinet contains the majority of individual electrical components that when combined together, form the basis for control on the machine.

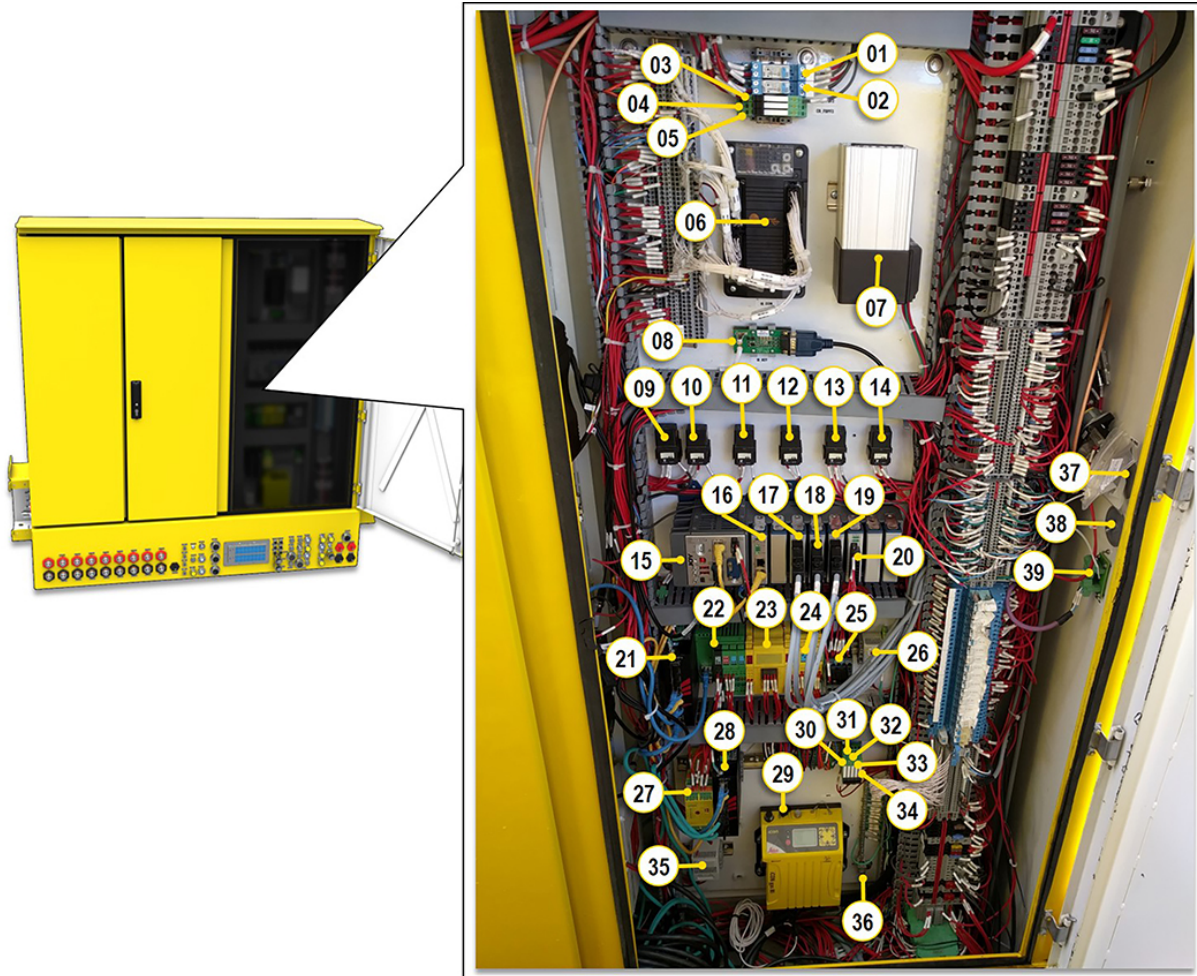
The main controller (15, [Figure 30](#)) is the primary means of connecting CAN components. It features interchangeable modules that allow for multiple networks worth of CAN components to communicate with the machine controller.

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Figure 30: Control Cabinet - Right Side



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01 - CR_DCL – Dust Curtain Lower Relay	15 - C_MC – Main Controller	27 - CR_ESTOP – Emergency Stop Relay
02 - CR_DCR – Dust Curtain Raise Relay	16 - COM_PROFI – Profinet Communication Slot #1	28 - IO_BC – Bus Coupler I/O Module (Profinet)
03 - CR_FPDF1 – Fuel Pump Filter 1 Control Relay	17 - IO_CCM1S3 – CAN Bus Communication Module #1 Slot #3	29 - GPS – Global Positioning System
04 - CR_FPDF2 – Fuel Pump Filter 2 Control Relay	18 - IO_CCM2S4 – CAN Bus Communication Module #2 Slot #4	30 - CR_CCV – Camera Change View Control Relay
05 - CR_FPDF3 – Fuel Pump Filter 3 Control Relay	19 - IO_CCM3S5 – CAN Bus Communication Module #3 Slot #5	31 - CR_RSL – TeleOp Red Strobe Light Control Relay
06 - IO_CCM – Control Cabinet I/O Module	20 - IO_TOM – TeleOp Output Module	32 - CR_TGSL – TeleOpGreen Strobe Light Control Relay
07 - CR_CCLT – Control Cabinet Low Temperature Control	21 - ES_CC – Control Cabinet Ethernet Switch	33 - CR_TB SL – TeleOp Blue Strobe Light Control Relay
08 - ID_KEY – Machine ID Key	22 - IO_BC – Bus Coupler I/O Module (Profinet)	34 - CR_TASL – TeleOpAmber Strobe Light Control Relay
09 - CR_P – Prelube Relay	23 - IO_RC – Remote Control I/O Module	35 - HTR_CCLT – Control Cabinet Low Temperature Heater
10 - CR_S1 – Starter #1 Start Relay	24 - IO_RCI – Remote Control Input Module	36 - Grounding Bar
11 - CR_S2 – Starter #2 Start Relay	25 - CR_REM – Remote Control Relay	37 - PB_ESBLR_A – Left Rear Boarding Emergency Stop Pushbutton
12 - CR_MPWL – Mast Platform Work Lights	26 - TH_CCLT – Control Cabinet Low Temperature Thermostat	38 - PB_SR – System Reset Pushbutton
13 - CR_WLC1 – Work Light Control #1 Relay		39 - REC EDI – Engine Dialog Interface
14 - CR_PH – Propel Horn Relay		

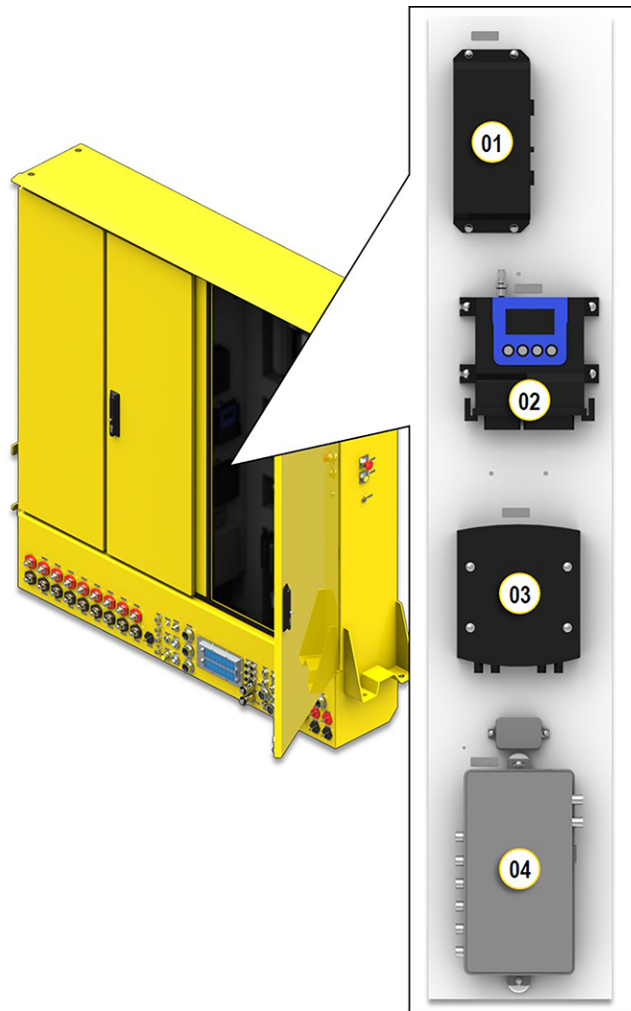
The right side wall of the control cabinet houses the majority of video components on the machine. The digital video recorder (01, [Figure 31](#)), records video from all camera sources. The video encoder (03, [Figure 31](#)) converts the natively recorded video format, to one that can be more easily displayed on the in-cab monitor. The video control unit (04, [Figure 31](#)) is used to select which camera is active, and what will be displayed inside the operator's cab.

The remote propel receiver (02, [Figure 31](#)) is also located on the right side wall. It connects to the antenna in [Figure 36](#).

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Figure 31: Control Cabinet - Right Side Wall

01 - V_DVR – Digital Video Recorder

**02 - RP_RECVR – Remote Propel Receiver (Optional)
Node ID: 6 (6h)**

04 - VC_CU – Video Control Unit

03 - VC_VE – Video Encoder

The left side of the control cabinet houses the majority of fuses, used for electrical components throughout the machine. They are distributed throughout [Figure 32](#) and [Figure 33](#).

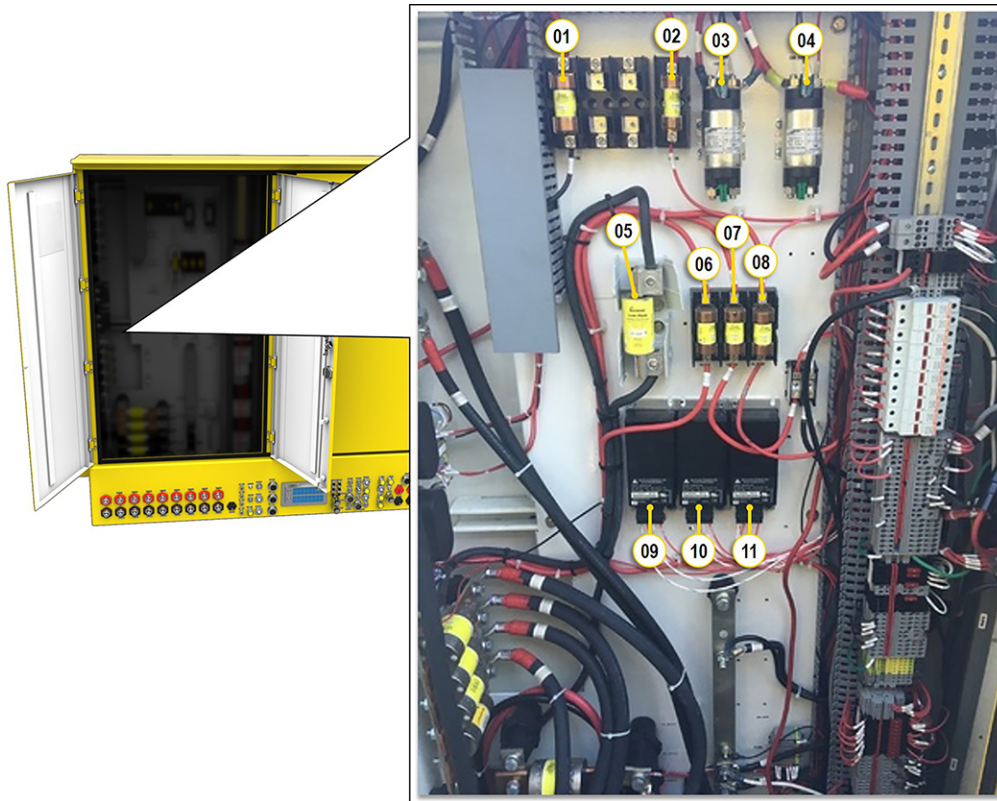
Note: An additional 24VDC regulated power supply (PS_24R4), may be installed on the left side control cabinet (adjacent to PS_24R3), depending on how the machine is optioned.

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Figure 32: Control Cabinet - Left Side 1



- 01 - FU_T3C – TeleOp 3D Camera Fuse
- 02 - FU_EU – Engine Control Unit Fuse
- 03 - CON_AS – Auxiliaries Start Contactor (300 Amp Power Relay)
- 04 - CON_MCC – Master Control Contactor (300 Amp Power Relay)

- 05 - FU_PL – Cummins Engine Pre-Lube Fuse
- 06 - FU_AE – Auxiliary Equipment Fuse
- 07 - FU_UPS – Control Cabinet UPS Fuse
- 08 - FU_MFBP – Main Fuel Booster Pump Fuse

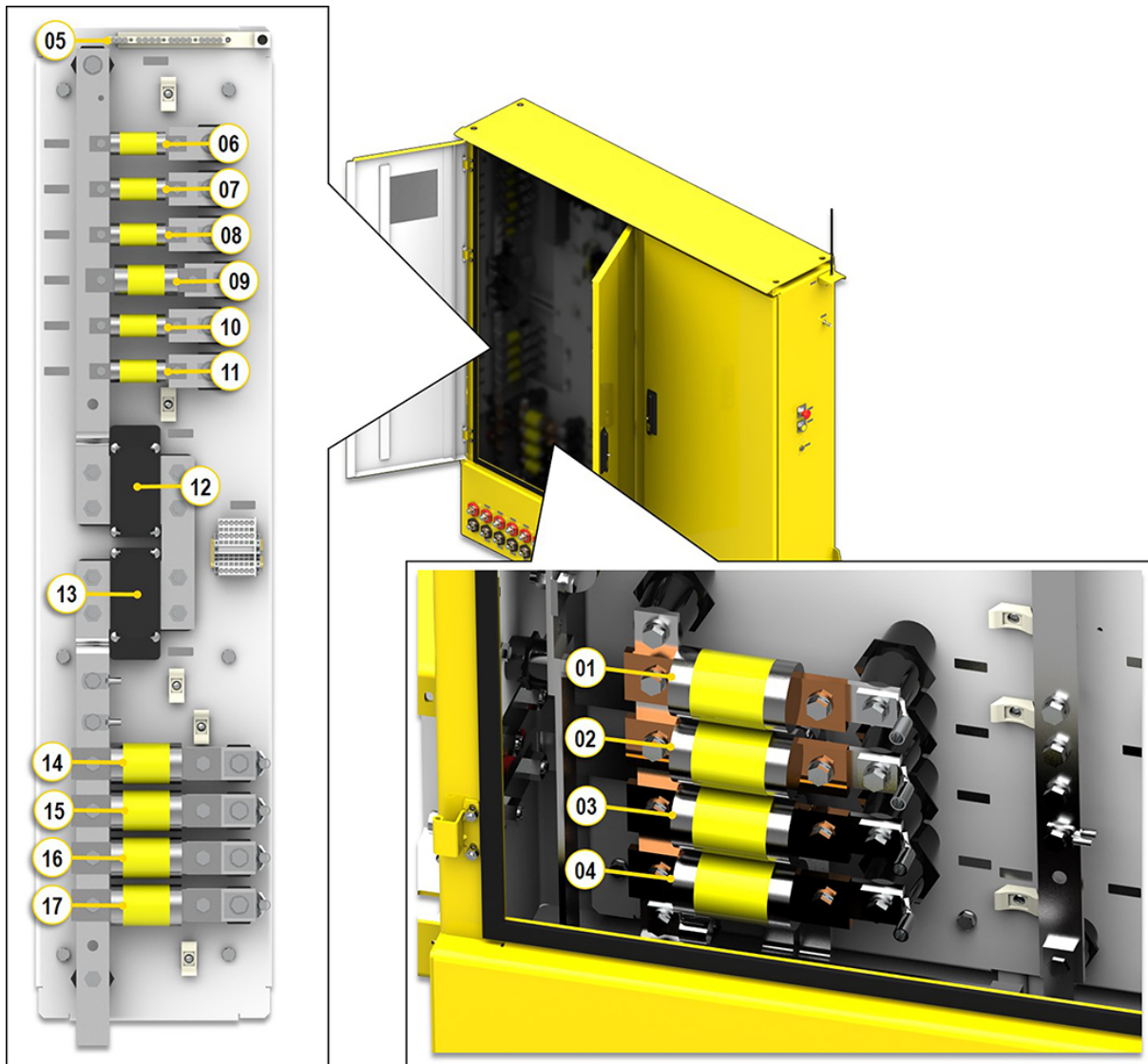
- 09 - PS_24R1 – 24VDC Regulated Power Supply #1
- 10 - PS_24R2 – 24VDC Regulated Power Supply #2
- 11 - PS_24R3 – 24VDC Regulated Power Supply #3

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Figure 33: Control Cabinet - Left Side 2



- 01 - FU_ES1C1 – Engine Starter #1 Cable #1 Fuse
- 02 - FU_ES1C2 – Engine Starter #1 Cable #2 Fuse
- 03 - FU_ES2C1 – Engine Starter #2 Cable #1 Fuse
- 04 - FU_ES2C2 – Engine Starter #2 Cable #2 Fuse
- 05 - Grounding Bar
- 06 - FU_IOPB – I/O Bus Power Fuse

- 07 - FU_AES1 – Auxiliary Equipment Supply #1 Fuse
- 08 - FU_AES2 – Auxiliary Equipment Supply #2 Fuse
- 09 - FU_OPC – Operator's Cab Power Fuse
- 10 - FU_ML – Machine Lighting Fuse
- 11 - FU_P – Power Fuse
- 12 - CON_MCP2 – Main Contactor Positive #2

- 13 - CON_MCP1 – Main Contactor Positive #1
- 14 - FU_ALT2 – Alternator Fuse #2
- 15 - FU_ALT1 – Alternator Fuse #1
- 16 - FU_APUA2 – Auxiliary Power Unit Alternator Fuse #2
- 17 - FU_APUA1 – Auxiliary Power Unit Alternator Fuse #1

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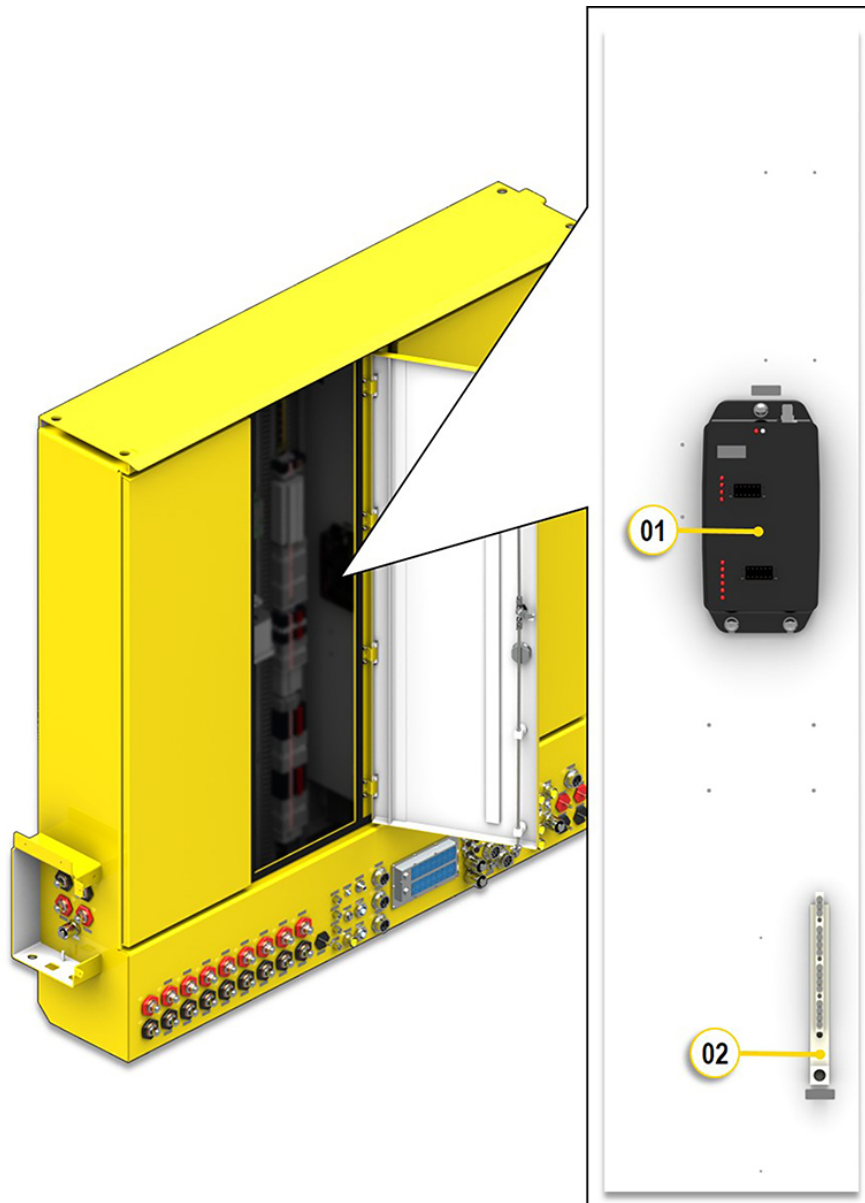
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The left side wall contains the chassis lighting I/O module (01, [Figure 34](#)) and a grounding bar.

Note: The connections seen in the lower left of [Figure 34](#) are for the battery cabinet, which is hidden in the image.

Figure 34: Control Cabinet - Left Side Wall



**01 - IO_CLM - Chassis Lighting
I/O Module**

02 - GR_CC - Grounding Bar

All main control cabinet connections are located on the bottom of the cabinet. All connections are protected from the deck by a solid walkway plate (as opposed to the walkway grate material used elsewhere).

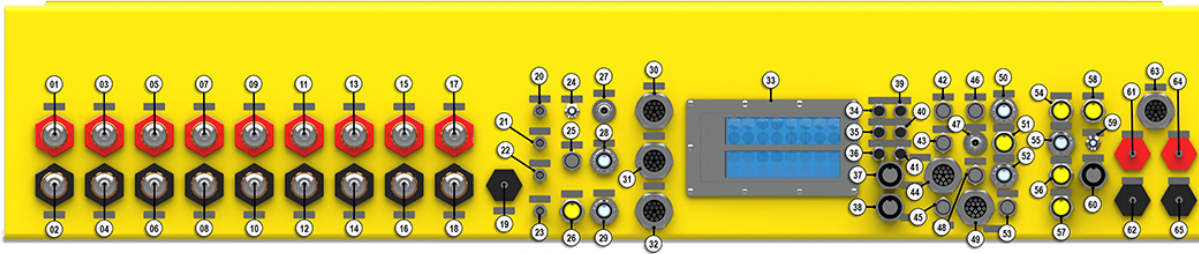
Power connections are primarily located on the left side, while sensor and camera inputs are located on the right side

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Figure 35: Control Cabinet Connections



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- | | | |
|---|---|--|
| 01 - DC_P – Deck Crane Powerpack Positive (10AA301) [Optional] | 18 - ST-S2N2 - Control Cabinet Starter #2 Negative #2 Stud | 35 - REC_VCBV - Video Camera Bit View Receptacle |
| 02 - DC_P – Deck Crane Powerpack Negative (10AA045) [Optional] | 19 - ST-CCG – Control Cabinet Ground | 36 - REC_VCLV - Video Camera Left View Receptacle |
| 03 - ST-APAP1 - Auxiliary Power Unit Alternator Positive Stud #1 [Optional] | 20 - REC_CMAF1S - Cooling Components/Hydraulic Fan 1 Speed Receptacle | 37 - REC_ES1 - Engine Starter #1 Receptacle |
| 04 - ST-APAN1 - Auxiliary Power Unit Alternator Negative #1 Stud [Optional] | 21 - REC_CMAF2S - Cooling Components/Hydraulic Fan 2 Speed Receptacle | 38 - REC_ES2 - Engine Starter #2 Receptacle |
| 05 - ST-APAP2 - Auxiliary Power Unit Alternator Positive Stud #2 [Optional] | 22 - REC_CEF1S - Cooling Engine Fan 1 Speed Receptacle | 39 - REC_VCMV - Video Camera Mast View Receptacle |
| 06 - ST-APAN2 - Auxiliary Power Unit Alternator Negative #2 Stud [Optional] | 23 - REC_CEF2S - Cooling Engine Fan 2 Speed Receptacle | 40 - REC_VCRRV - Video Camera Rear View Receptacle |
| 07 - ST-EAP1 – Engine Alternator Positive Stud #1 | 24 - REC_CCTE - Control Cabinet TeleOp Ethernet Receptacle | 41 - REC_VCRV - Video Camera Right View Receptacle |
| 08 - ST-EAN1 – Engine Alternator Negative #1 Stud | 25 - REC_ALIOB - Auto Level I/O Bus Receptacle | 42 - REC_MCIOB - Mast/Carriage I/O Bus Receptacle |
| 09 - ST-EAP2 – Engine Alternator Positive Stud #2 | 26 - REC_RFBES - Right Front Boarding Emergency Stop Receptacle | 43 - REC_CIOBP1 - Chassis I/O Bus Power #1 Receptacle |
| 10 - ST-EAN2 – Engine Alternator Negative #2 Stud | 27 - REC_GA1B - GPS Antenna #1 Bulkhead Receptacle | 44 - REC_CCRDBB - Control Cabinet Rear Deck Breakout Box Receptacle |
| 11 - ST-S1P1 – Control Cabinet Starter #1 Positive Stud #1 | 28 - REC_CCAL - Control Cabinet Auto Level CAN Communication Receptacle | 45 - REC_FIRE - Control Cabinet Fire System Receptacle |
| 12 - ST-S1N1 – Control Cabinet Starter #1 Negative #1 Stud | 29 - REC_ROCC - Remote Operation CAN bus Communication Receptacle | 46 - REC_AHIOB - Chassis I/O Bus Power #2 Receptacle |
| 13 - ST-S1P2 – Control Cabinet Starter #1 Positive Stud #2 | 30 - REC_CCLF - Control Cabinet Left Front Receptacle | 47 - REC_GA2B – GPS Antenna #2 Bulkhead Receptacle |
| 14 - ST-S1N2 – Control Cabinet Starter #1 Negative #2 Stud | 31 - REC_CCRF - Control Cabinet Right Front Receptacle | 48 - REC_CCGT |
| 15 - ST-S2P1 – Control Cabinet Starter #2 Positive Stud #1 | 32 - REC_CCMP - Control Cabinet Mast Platform Receptacle | 49 - REC_CCRBB – Control Cabinet Right Rear Breakout Box Receptacle |
| 16 - ST-S2N1 – Control Cabinet Starter #2 Negative #1 Stud | 33 - Compression Clamping Assembly | 50 - REC_CCCMC – Control Cabinet CAN Communications Mast/Carriage Receptacle |
| 17 - ST-S2P2 – Control Cabinet Starter #2 Positive Stud #2 | 34 - REC_VCFV - Video Camera Front View Receptacle | 51 - REC_LRBES – Left Rear Boarding Emergency Stop Receptacle |
| | | 52 - REC_CCCB – Control Cabinet Chassis CAN Communication Bus Receptacle |

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53 - REC_CCEP – Control Cabinet Engine Pre-lube Receptacle

54 - REC_TCRC – TeleOp Cab Remote Control Receptacle

55 - REC_CCCC – Control Cabinet Cab CAN Communication Receptacle

56 - REC_MBES – Main Boarding Emergency Stop Receptacle

57 - REC_TRC – TeleOpRemote Control Receptacle

58 - REC_CCC1 – Control Cabinet Cab Control Receptacle #1

59 - REC_CCCE – Control Cabinet Cab Ethernet Receptacle

60 - REC_CCUPS – Control Cabinet Cab UPS Receptacle

61 - ST-CC24VS1 – Control Cabinet 24 Volt Supply Stud #1

62 - ST-CC0VS1 – Control Cabinet 0 Volt Supply Stud #1

63 - REC_CCCRDBB - Control Cabinet Rear Deck Breakout Box Receptacle

64 - ST-CC24VS2 – Control Cabinet 24 Volt Supply Stud #2

65 - ST-CC0VS2 – Control Cabinet 0 Volt Supply Stud #2

An emergency stop button (01, [Figure 36](#)) is located on the rear of the control cabinet. When depressed it will immediately stop the machine and set the drill's parking brakes. When depressed, the switch latches closed. After whatever event that caused the need for an emergency stop has been remedied, the switch must be manually pulled out and rotated, to be ready for use again.

The emergency stop system reset button (02, [Figure 36](#)) is used to reset the machine after it has been stopped by means of any of the emergency stop buttons. After the particular emergency stop button, that triggered the shut down is reset, the system reset button is depressed to allow the drill to be restarted.

An engine dialog interface (03, [Figure 36](#)) allows for the diesel engine to be connected to a manufacturer's specific diagnostic tool. Depending on the diesel engine installed, the connector may vary.

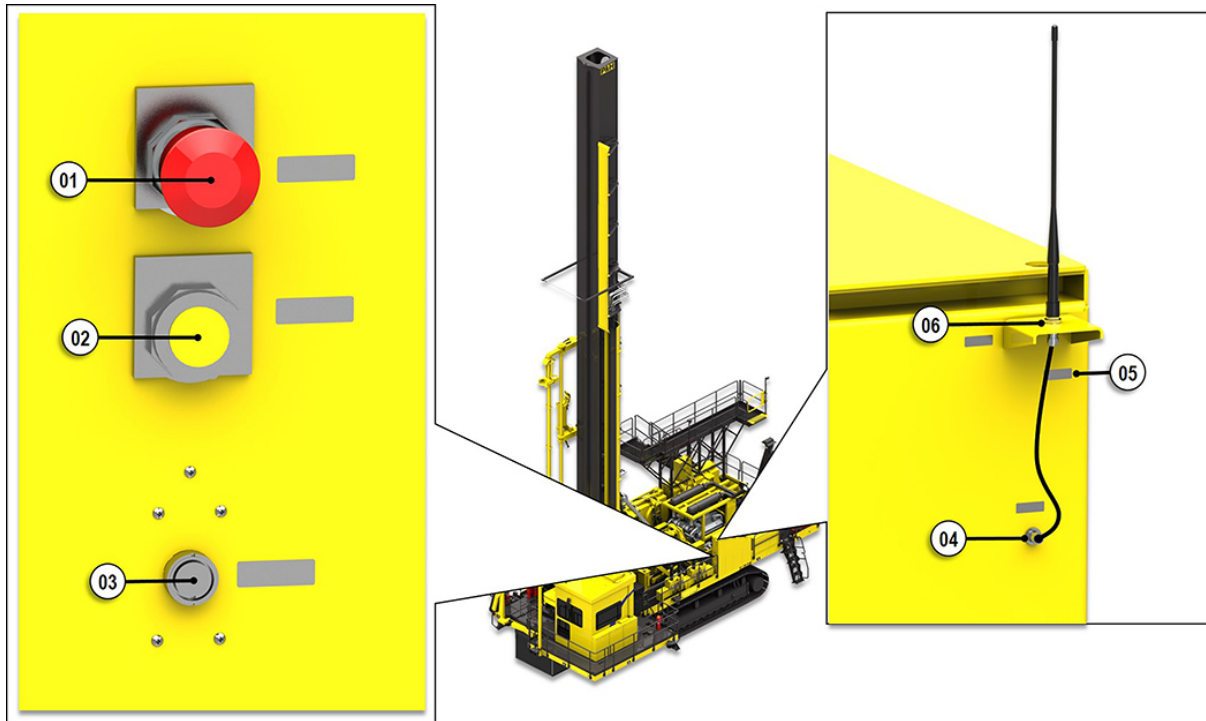
The antenna (06, [Figure 36](#)) for the remote propel transmitter is located on the rear top corner of the control cabinet.

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Figure 36: Control Cabinet Emergency Stop & Reset Switch



01 - PB_MECC – Emergency Stop Button

02 - PB_SR – System Reset Push Button

03 - REC_ED1 – Engine Dialog Interface

04 - REC_RAB1 – Radio Antenna Bulkhead #1 Receptacle

05 - REC_RAB2 – Radio Antenna Bulkhead #2 Receptacle

06 - ANT_RPE – Remote Propel External Antenna

Two disconnects switches are located on the left side of the machine. They are intended to be used during maintenance or when the machine is off for more than one hour.

The starter disconnect switch (01, [Figure 37](#)) prevents the diesel engine from being started. When starter has power to it, the starter power light (02, [Figure 37](#)) will be illuminated yellow.

The battery disconnect switch (03, [Figure 37](#)) removes electrical power from the machine. When battery power is available, the main battery power light (04, [Figure 37](#)) will be illuminated red.

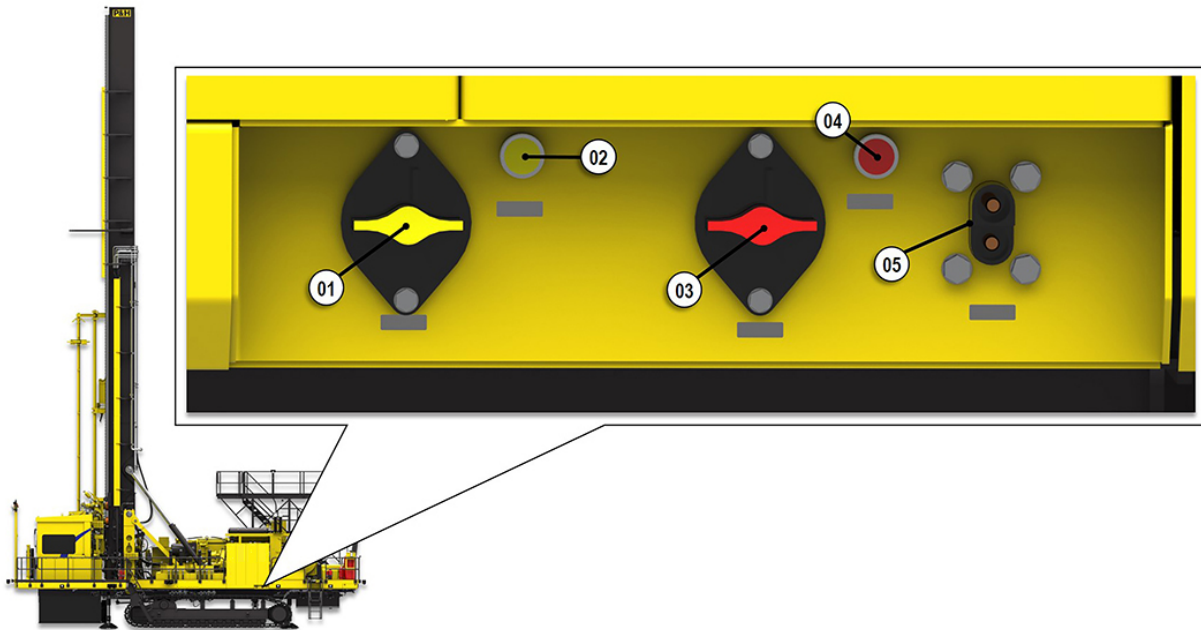
In the event of a dead battery, the machine's batteries can be recharged via the battery charging socket (05, [Figure 37](#)).

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Figure 37: Control Cabinet Lockouts & Charging Port



01 - DS_SDS - Starter Disconnect Switch

02 - LT_SP - Starter Power Light

03 - DS_BDS - Battery Disconnect Switch

04 - LT_PWR - Main Battery Power Light

05 - REC_JS - Battery Charging Socket

Battery Cabinet

Refer to [Figure 38 : Battery Cabinet](#).

The battery cabinet is located just in front of the control cabinet (on the right side of the machine). It contains the four master batteries (01, 02, 03, & 04, [Figure 38](#)) that are used to power the 24 volt system.

The batteries are used to start the control system and the diesel engine. When the engine is off, power for the lights, and all other electrical components are being drawn from the battery cabinet. Once the diesel engine is running the alternator generates the electrical power used by the machine. The alternator is also used to maintain a constant charge on the batteries.

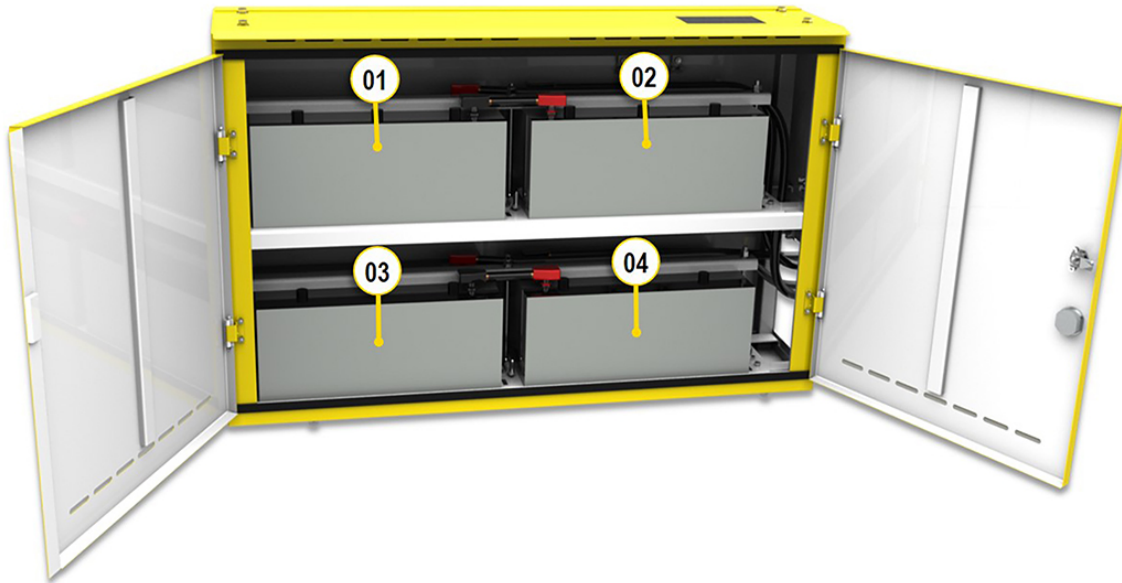
The battery cabinet contains four heavy duty, 8D sized 12 volt AGM batteries. Each shelf (top and bottom) is arranged in a series configuration, so both batteries together generate 24 volts.

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Figure 38: Battery Cabinet



01 - BA_MB1 – Master Battery
#1

03 - BA_MB3 – Master Battery
#3

04 - BA_MB4 – Master Battery
#4

02 - BA_MB2 – Master Battery
#2

NOTICE

The battery cabinet is designed **only** for AGM (absorbed glass mat) batteries. **Never** replace an AGM battery, with a standard lead acid battery.

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