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Enterprise Electronics Corporation

TECHNICAL DOCUMENTATION SET
OPERATIONS AND TECHNICAL MANUAL

RANGER® X5

FUNCTIONAL OVERVIEW AND THEORY OF OPERATIONS

DESIGNED AND MANUFACTURED FOR:
MOBILE CONFIGURATIONS

SECTION 1

JOB 9819

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Encoded Transmitted Signal In A Simultaneous Dual Polarization Weather System
United States Patent
US 7,439,899

Phase Shifted Transmitted Signals In A Simultaneous dual Polarization Weather System
United States Patent
US 7,551,123

Simultaneous Dual Polarization Radar System with Optical Communications Link
United States Patent
US 7,760,129

Simultaneous dual polarization radar systems offered by EEC are covered by one or more of the follow patents:
United States Patents

US 6,859,163 B2	(Inv-1)
US 6,803,875 B1	(Inv-2)
US 7,049,997	(Inv-3)

Foreign Patents

1200500266/13041 (OAPI African Organization)	(Inv-1)
200501316/009250 (EA Eurasia)	(Inv-1)
13694 (OAPI African Organization)	(Inv-3)
2394254 (Russia)	(Inv-3)

Simultaneous Dual Polarization Radar System Inv-2
Patented under European patent number 1608997

Various additional domestic and international patents have been applied for.

Validity Date: 24 September 2015

FCC Part 15.19 Warning Statement- (Required for all Part 15 devices)

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

FCC Part 15.21 Warning Statement

NOTE: THE GRANTEE IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

FCC Part 15.105(b) Warning Statement- (ONLY Required for 15.109-JBP devices)

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the manufacturer or an experienced radio/TV technician for help.

FCC Part 2.1091 Radiation Safety Warning

NOTE: This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 22.43m between the radiator and any part of your body.

Revision Information

REVISION	DATE	MODIFICATION
1.0	15 November 2014	Initial Version
1.1	3 February 2015	Updated with latest technical changes per ECNs
1.2	9 September 2015	Updated with latest changes. Added the INDOOR Cabinet to the manuals.
1.3	7 April 2016	Updated information and graphics for pedestal section.
1.4N	31 October 2016	Update for NBC TRUCK Configurations – BRANCH VERSION
1.5A	6 Feb 2017	Pre-Delivery Version for J9819 – part numbers not yet updated.
1.6	14 Feb 2017	Added FCC Disclaimer and Updated ALL Part Numbers
1.7	15 March 2017	Updated FCC RF exposure statements antenna gains
1.8	27 March 2017	Updated images for Transmitter Control Assembly

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INTRODUCTION

SYSTEM INTRODUCTION AND OVERVIEW

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The Enterprise Electronics Corporation (EEC) Ranger-X5 radar system is a new generation, X-band (3 cm), Adaptive Polarization Doppler Weather Surveillance Radar that fills the gap between high-cost, high-power traditional radar systems and the passive ground-station weather sensors. The system uses relatively low power solid-state transmitters and pulse compression technology to attain nearly the same performance capabilities of much more expensive traditional radar systems. The Ranger-X5 employs Adaptive Dual Polarization (ADP) techniques to allow Alternating or Simultaneous Dual Polarization capability with total control over the transmission polarization state using dual independent coherent transmitters.

The entire Ranger-X5 design concept emphasizes precision, stability, reliability, and value using proven solid-state technology combined with the most advanced motion control system ever conceived for weather radar. The sealed, lubricated for life, mechanical drive system in the Ranger-X5 has an MTBF in excess of 180,000 hours without the need for routine maintenance or lubrication. The motion system provides extremely high torque to weight ratios for outdoor operation and greater than 40 arc-second position accuracy.

Advanced configurations and networks of systems are available that meet all of the requirements for special missions, such as aviation or hydrological forecasting applications.

The flexible architecture and system design facilitates automatic remote operations, ensures minimal maintenance costs, and provides maximum configurability to meet specialized customer needs. The Ranger-X5 is designed for continuous (24 hours/day), unattended operations at remote locations, providing the full suite of polarimetric radar data for local single-site operations, as a member of a network with predefined product contributions or, as the manager of a network of remote users providing specific radar products to suite the individual user's needs.

The Ranger-X5 radar system is a lightweight, high performance system designed for tactical grade deployments on a wide variety of fixed and mobile platforms. This densely packed system provides stability, stiffness, position accuracy and raw power directly coupled to the payload.

The 1-meter variant shown in **Figure 1** is capable of supporting full operation in sustained winds up to 75 mph, and with wind gusts to 90 mph. To deliver radar and motor cooling, the system provides for water-cooling using naval shipboard cooling techniques.

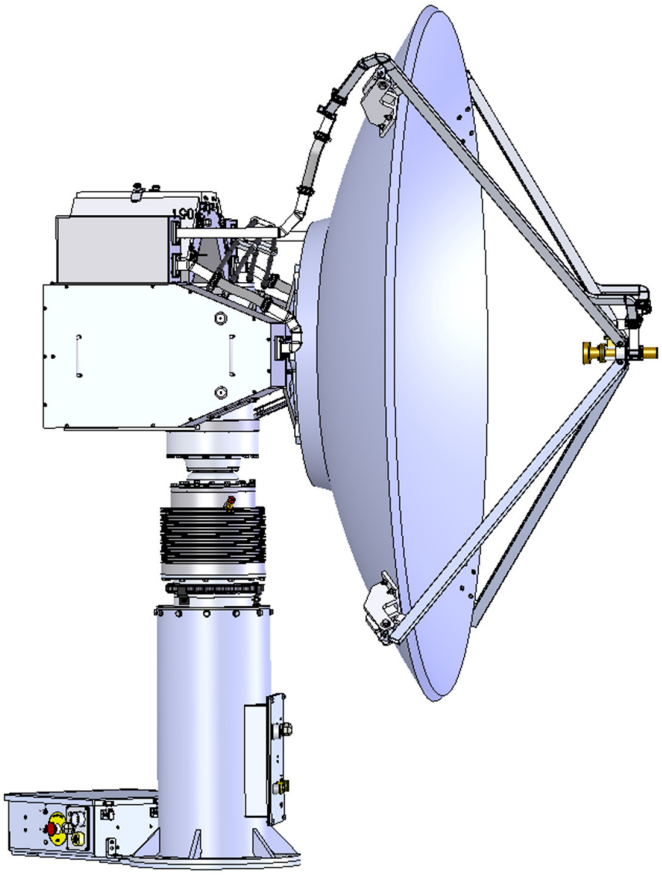

Figure 1. 1.8-Meter Ranger-X5 Variant

The standard Ranger-X5 system configuration includes an elevation over azimuth pedestal providing on-board, environmentally sealed, and controlled electronics housing for the transmitters, receivers, and signal digitizer in conjunction with a NEMA 4 grade environmentally controlled ground interface enclosure. The ground interface contains the system power supplies, EEC IQ2 signal processor, Local Control Interface (LCI) station, Radar Control Unit (RCU) Computer running EEC COBRA software, EEC EDGE software system workstation, and associated communication interfaces. The ground interface enclosure is not required with customer furnished facilities.

The standard configuration uses two 500-Watt transmitters located on the pedestal above the elevation rotational axis to support Dual Polarization operation. This design eliminates the need for waveguide switches, waveguide rotary joints, or a power splitter, allowing for complete diversity in H/V measurement schemes and minimum path loss in both the transmission and reception path.

The radar system provides standard precipitation intensity, turbulence, and velocity modes of analysis with extremely high precision in all modes of operation. Normal radar control and data processing utilizes the EDGE Radar Control and Analysis Software. A separate technical manuals describes the functions of EDGE.

The transmitter provides a 500W peak RF power pulse (in each channel) with an adjustable pulse width from 0.2 and 100.0 microseconds (µs), providing excellent weather detection at range in all modes. The transmitter radiates in staggered Pulse Repetition Frequency (PRF) modes at 3:2, 4:3, or 5:4 ratio allowing dual PRF sampling by the digital signal processor to produce maximum unambiguous velocities of up to ≥90 meters/second.

The EEC IQ2-IFD Intermediate Frequency Digitizer ingests and digitizes the received radar return in 16-bit resolution. The receiver design utilizes state-of-the-science components to optimize

detection sensitivity, bandwidth, dynamic range, measurement accuracy, and useful life.

The IQ2-IFD converts the analog receiver IF signals into the digital domain. The IQ2-DSP Digital Signal Processor receives the digitized Inphase / Quadranture (I/Q) data via the PCI receiver card. The I/Q data stream is pre-processed and polar rays of meteorological moments are generated. The ray data is sent via a 1Gbit TCP/IP connection to the IQ2-DSP Signal Processor for storage and further processing. The IQ2 design optimizes detection sensitivity, bandwidth, dynamic range, measurement accuracy, and useful life.

The IQ2-DSP is the central data processing point for the radar. The IQ2-DSP is an advanced scientific computer system utilizing the Linux operating system and employs advanced scientifically validated algorithms. The standard mode of operation is the proven pulse-pair method of Doppler processing to produce the standard data moments of Uncorrected Reflectivity (U), Corrected Reflectivity (ZH), Vertical Reflectivity (ZV), Velocity (V), and Spectrum Width (W). In addition to the standard base Moments, the system provides the Polarimetric Base Moments Differential Reflectivity (ZDR), Differential Phase (ΦDP), Specific Differential Phase (KDP), Correlation Coefficient (ρHV), and Linear Depolarization Ratio (LDR), (where applicable). The derived moment of rainfall (R) is also included.

General system control utilizes the standard EEC Radar Control Unit (RCU). The RCU is used to correlate and process BITE information from the various modules and procedures, control the antenna pedestal operational parameters and perform basic radar control. The RCU integrates closely with the IQ2 Digital Receiver and IQ2 Digital Signal Processor, communicating by standard Ethernet Protocol.

The radar system design allows for easy maintenance and has a manually selectable local/remote mode to permit maintenance personnel to gain local control of the radar system. Local control is implemented on a Local Control Interface (LCI) Display using a system of menus and status screens. With the automatic calibration functions and easily accessible system test points, any necessary system testing, calibration, or repair is easily accomplished with minimum down time.

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CHAPTER 1

CONTROL CABINET (UNIT 1)

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1. Control Components

The Control Components are mounted in special configurations. The layout is significantly different that cabinet mounted versions of the Ranger-X5 systems.

1.1. Control Components Housing (Unit 1)

The Ranger-X5 Control Cabinet houses the Keyboard Video Monitor (KVM), Signal Processor, and Radar Control Unit, Local UPS, Power Controller, DC Power Supplies and the Communications Interface for the radar system. The components are located in a rack and connected to the pedestal and transceiver units via a fiber-optic communications connection and DC power cables.

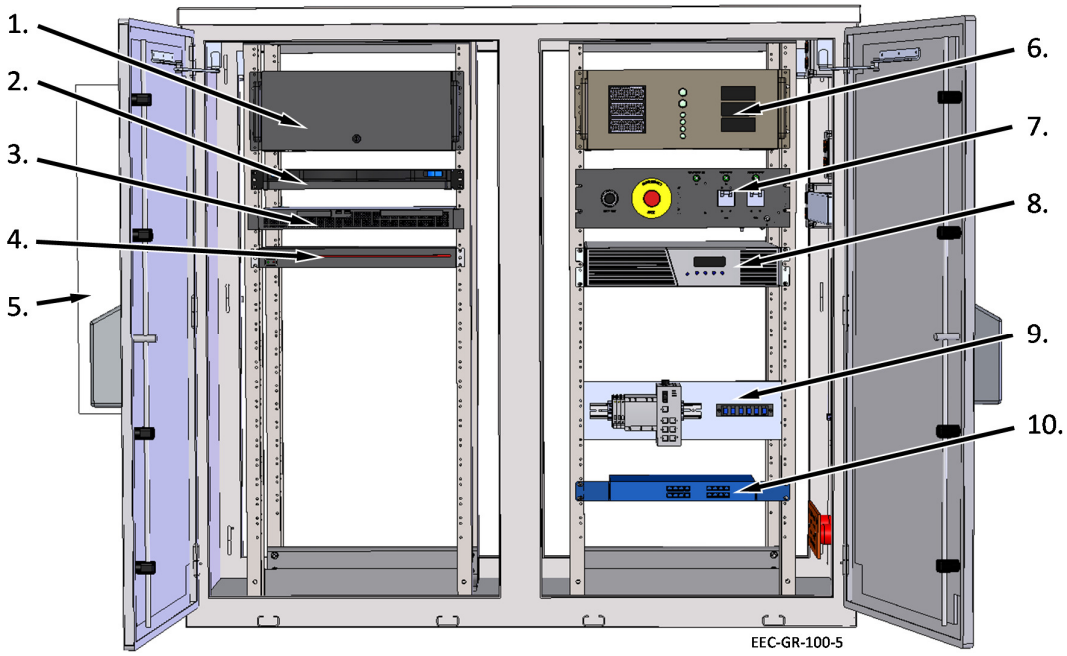

Figure 2. Control Cabinet (Climate Controlled) – 137043-100 (Front)

1. EDGE Workstation
2. Keyboard Video Monitor (A3) – 132507-100
3. Radar Control Unit (A1) – 133784-100
4. Power Distribution Unit (A6) – VMR-8HD20-2
5. Air Conditioning Unit
6. IQ2 Digital Signal Processor (A2) – 134119-100
7. E-Stop Panel Assembly (A12) – 134933-100
8. UPS, 2000/1800 KVA (A9) – PW91302000R-XL
9. FO Media Converter Assembly (A8) – 133116-100
10. 16-Port Ethernet Switch (A5) – JGS516

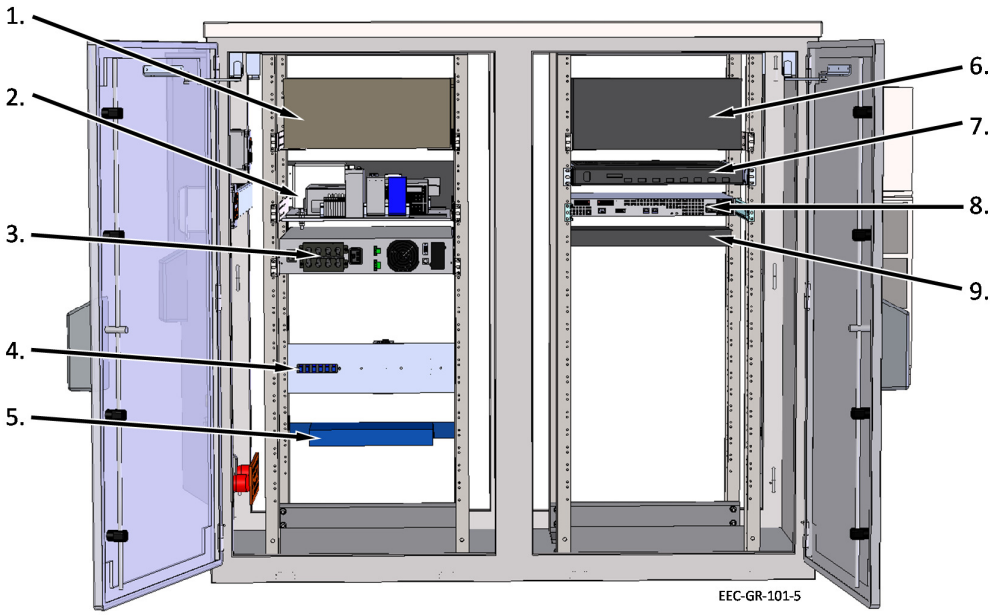

Figure 3. Control Cabinet (Climate Controlled) – 137043-100 (Rear)

1. IQ2 Digital Signal Processor (A2) – 134119-100
2. DC Power Distribution Plate (A13) – 134932-100
3. UPS, 2000/1800 KVA (A9) – PW91302000R-XL
4. FO Media Converter Assembly (A8) – 133116-100
5. 6-Port Ethernet Switch (A5) – JGS516
6. EDGE Workstation
7. Keyboard Video Monitor (A3) – 132507-100
8. Radar Control Unit (A1) – 133784-100
9. Power Distribution Unit (A6) – VMD-8HD20-2

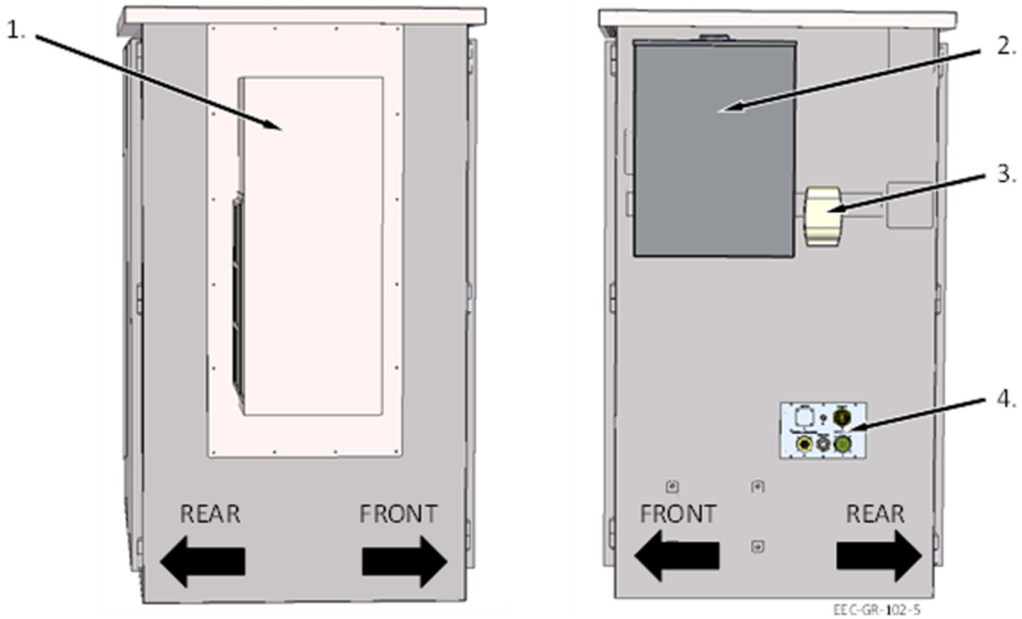

Figure 4. Control Cabinet (Climate Controlled) – 137043-100

1. Air Conditioning Unit
2. A/C Circuit Breaker Box
3. GFCI Power Outlet
4. I/O Panel Assembly (135204-100)

1.1.1. RCU with Serial Card (Unit 1 A1)

The RCU host computer is a Linux based standard industrial PC that physically converts to Ethernet I/O slave modules to control and monitor radar hardware, using the open industrial standard ModbusTCP for communications. The Radar Control Unit is loaded with Cobra Software (**See Section 3, RCU Cobra Software**).

Implementation of command and control of the pedestal is over the Ethernet link from the Radar Control Unit PC (COBRA Application software) all of the other components in the Control Cabinet and the Pedestal Unit. The control of the azimuth and elevation servo is directly through an Ethernet connection to the Servo Controller Assembly.

Position commands route to the Servo Controller from the COBRA software system based on commands from either the Local Control Interface (LCI) or the remote host operator. A position command invokes a command interpreter script in COBRA that sends the appropriate command to the pre-loaded servo control module. The Servo Controller has an extensive standard command and control set and an extended command set for use with radar servo systems.

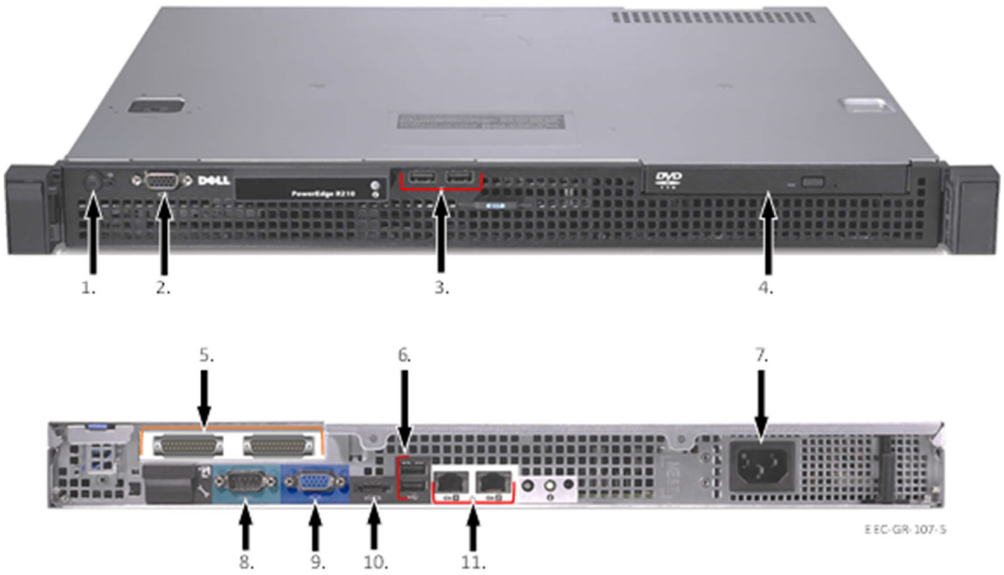

Figure 5. Radar Control Unit (133784-100)

1. Power Switch
2. Front VGA Port
3. Front USB Ports (2)
4. DVD Drive
5. Synclink Ports (2) – (IQ2-DSP Connect)
6. Rear USB Ports (2) – (KVM Connect)
7. Power Connect
8. RS232 Port (Inclinometer) – (OPTIONAL)
9. VGA Port (KVM Connect)
10. eSATA Port
11. Ethernet (2) – (Ethernet Switch)

1.1.1.1. COBRA RCP Module

The COBRA Radar Control Processor (RCP) module controls the radar hardware through a series of coordinated and supervised hardware Analog and Digital control modules. These I/O modules connect to the RCU by Ethernet. The Ethernet communication layer between the RCU and the distributed modules is functionally isolated from any point beyond the RCU so there is no danger to having a remote host attempt to communicate directly with the hardware control modules.

The COBRA RCP software is hardware independent through a software abstraction layer. This allows easy transition to other vendors and products based on availability and features

In order to assure accurate and complete time stamping of each command, response, and status, each module comprising the RCU is synchronized using the Network Time Protocol (NTP). Additionally, filters and other integrity checks within the RCU and associated software elements ensure that any command, response, error message, or status message is appropriately logged and repeated entries are avoided.

1.1.1.2. COBRA HCI Module

The COBRA HCI software module operates at the gateway between the RCP module and the EEC EDGE Radar Host computer.

1.1.1.3. COBRA LCI Module

The Local Control Interface (LCI) module is a computer based local control and operator interface to the COBRA program functions. In this configuration, the LCI runs on the same computer as the COBRA software. The user display shares the standard commercial keyboard and video monitor unit with the IQ2-DSP and EDGE Host computer.

The software communicates with various radar components through the COBRA application software in order to provide user commands to the system and reflect control and status data to the user. Such data includes but is not limited to azimuth and elevation position, power levels, and voltage/current measurements. The ability to monitor the radar performance over Ethernet connections provides the flexibility and opportunity to monitor the radar from virtually anywhere.

LCI presents the radar control information as familiar indicators and controls on the computer screen as a virtual control panel. Common indicator styles include the LED, round gauges and seven-segment digital readouts. Some indicators switch views when clicked. Interaction is through the keyboard and touch pad.

1.1.2. IQ2 Digital Signal Processor (Unit 1 A2)

The IQ2 DSP consists of a PCIe card in a high-performance Host Computer used for signal processing deployed in the Control Cabinet. This design of the computer and PCIe card ensures the highest performance available, as well as for flexibility in adapting to various radar system configurations. The DSP receives digital I/Q over the high-speed optical link from the IQ2-IFD, passes this data to the high-speed server for moments processing.

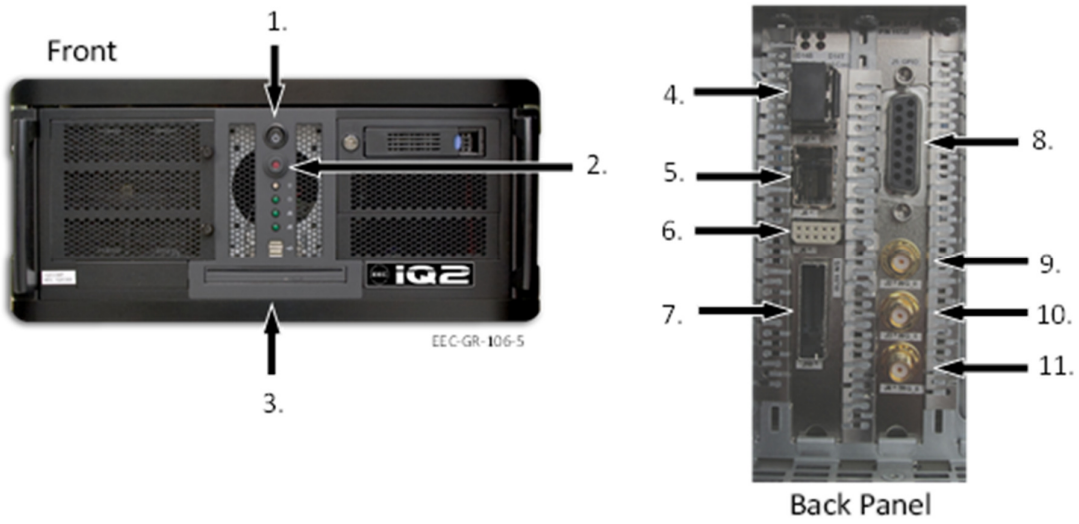

Figure 6. IQ2-DSP Computer (134119-100)

1.	Power Switch
2.	Power Indicator
3.	DVD Drive
4.	J7 - Fiber-Optic Connect
5.	J8 – Ethernet
6.	J6 – Antenna Serial Anglers
7.	J10 – PCIe Connect
8.	J1 – GPIO
9.	J2 – Waveform Generator (Primary)
10.	J3 – Waveform Generator (Secondary)
11.	J4 – Trigger Output

1.1.2.1. IQ2 Host Computer (Unit 1 A2 A1)

The IQ2-DSP Host Computer is equipped with a powerful, state-of-the-art, signal processor that receives In-Phase and Quadrature (I/Q) data from the IQ2-IFD coming in real time. The Signal Processor elaborates the real-time I/Q data to create the required single and dual polarization meteorological moments.

The IQ2-DSP consists of a PCIe communications card plugged into a high-speed server. The PCIe card receives the high-speed optical link from the IQ2-IFD, passes this data to the high-speed server for the processing of meteorological moments, and provides additional interfaces that may be required to support other radar-site systems.

The IQ2-DSP Host Computer processes the I/Q data stream, already broken into range-gate intervals, with floating-point algorithms to provide all required moments. The server also provides all the configuration and control signals to all of the components in the IQ2-DSP system.

The IQ2-DSP Host Computer is a Linux based standard industrial PC. The standard mode of operation is the well-defined, proven pulse-pair method of Doppler radar data processing that produces the standard data moments of:

- Uncorrected Reflectivity (U)
- Corrected Reflectivity (ZH)
- Vertical Reflectivity (Zv)
- Velocity (V)
- Spectrum Width (W)

When processing dual-polarization data, the IQ2-DSP also produces:

- Differential Reflectivity (ZDR)
- Differential Phase (ΦDP)
- Specific Differential Phase (KDP)
- Correlation Coefficient (ρHV)
- Linear Depolarization Ratio (LDR)

The standard IQ2-DSP algorithms for the horizontally and vertically polarized channels include but are not limited to the following:

- Thresholding: Noise, SQI 1& 2, SIGPOW, CCOR, & RHOHV
- Speckle Remover: Z, V, W, & DP
- Averaging: Time and Range
- Doppler Clutter Filters: Time- and Frequency- Domain
- Pulse-Pair Processing
- Discrete Fourier Transform (DFT) Processing
- Staggered PRT Processing or Dual PRT (DPRT)
- Second Trip Processing
- Range-Doppler Dilemma.

Each moment for the current mode of operations routes to the EDGE radar product generator for further processing and display.

The IQ2-DSP produces the IF transmit pulse input to the RF/IF Up-Converter Assembly in the Modulator Cabinet. The IQ2-DSP is the master radar synchronizer using a very stable, accurate trigger generator to produce the system control and timing signals during normal REMOTE and LOCAL operations.

1.1.2.2. IQ2 DSP PCIe Board (Unit 1 A2 A2)

The EEC IQ2-DSP utilizes a PCIe used for signal processing deployed in the Control Cabinet. This IQ2-DSP Host Computer and PCIe card design allows for the highest performance available, as well as for flexibility in adapting to various radar system configurations. The IQ2 IFD is in an RF Enclosure above the elevation rotary joint. This configuration ensures system optimization for low transmit and receive losses, as well as for very high data throughput.

1.1.2.3. IQ2 Connector Panel (Unit 1 A2 A3)

The connector panel allows the IQ2 Digital Signal Processor to connect with and communicate with the IQD-IFD and the EDGE workstation.

1.1.3. Keyboard Video Monitor (Unit 1 A3)

The Keyboard/Video Monitor (KVM) is a control unit that allows access to multiple computers from a single keyboard, video monitor, and mouse console. The configuration of the KVM allows it to control the RCU and IQ2-DSP. A local host computer (EDGE) also connects to the KVM. The cover had a built-in LCD display, and the keyboard and touchpad are built-in to the base. The KVM module fully integrates into the cabinet and can slide out and open for use.

Figure 7. Keyboard, Video Monitor (132507-100)

1.	17-Inch Display
2.	Source Selection
3.	Keyboard
4.	Touchpad
5.	EDGE (V1)
6.	RCU (V2)
7.	IQ2-DSP (V3)

The keyboard has a standard laptop-style touchpad with two command buttons for manipulation of the command cursor and executing operator commands. The display screen is a 17-in. liquid crystal display (LCD) color monitor.

Key features of the KVM include:

- Integrated KVM console featuring a 17-in. LCD color monitor in slide-away housing
- LCD module rotates up to 115° for a more comfortable viewing angle
- 105-key keyboard
- Compatible with all operating systems (O/S) platforms PC (Windows, Linux, Unix, Mac)
- Less than 1U high mountable rack
- Auto PS/2 and universal serial bus (USB) interface detection
- Internal built-in power
- Dedicated hotkey mode and on-screen display (OSD) invocation keys
- Computer selection via pushbutton, hotkeys and OSD
- Superior video quality - up to 1280x1024
- A-Grade thin-film-transistor (TFT) LCD panel
- RoHS compliant.

1.1.4. EDGE Workstation (Unit 1 A4)

The EDGE Workstation (see separate EDGE Manual) is a standard computer system nearly identical to the IQ2-DSP computer system. The EDGE software operates on the Linux platform and shares the KVM with the IQ2-DSP and RCU systems.

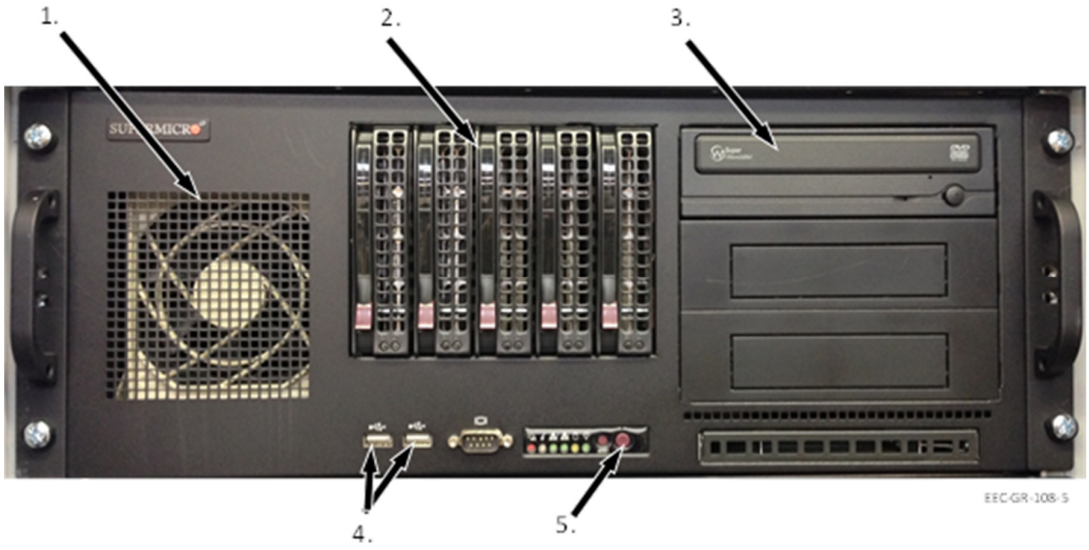

Figure 8. EDGE Workstation, Rack Mount

1. Cooling Fan
2. Raid Drives
3. DVD Drive
4. USB Ports
5. Power Button

EDGE Computer Characteristics	
Processor	Intel Xeon quad-core 5520 or superior
Memory:	16GB DD3
Disk:	1TB in RAID1, including SATA RAID Card
Ethernet:	Two Gigabit Ethernet ports
Operating System:	Linux
Extra Drive Bay	16X DVD R/W
Video Card	Nvidia GTS 450 1GB or better

Table 1. EDGE Computer Characteristics

1.1.5. 16-Port Gigabit Ethernet Switch (Unit 1 A5)

The 16-Port Ethernet Switch provides connectivity between components in the system and the RCU. The 16-Port Ethernet Switch has up to 48 Gbps of bandwidth and can blast 2000 Mbps per port. Each port is equipped with 10/100/1000 automatic speed and full/half-duplex sensing plus Auto Uplink to adjust for straight-through or crossover cables to make the right link.

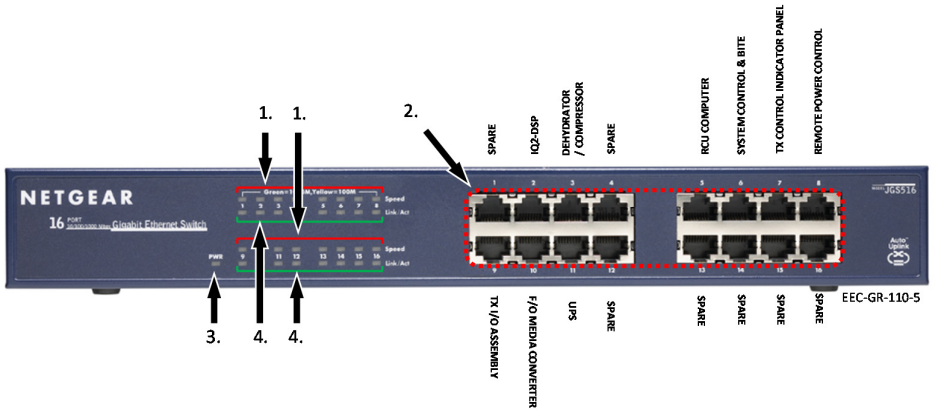

Figure 9. 16-Port Gigabit Ethernet Switch (JGS816)

1.	Speed Indicator LEDs
2.	Ethernet Connections
3.	Power Indicator LED
4.	Link Activity LEDs

1.1.6. Power Distribution Unit (Unit 1 A6)

The Power Distribution Unit accepts the incoming 2-phase AC power from the Power Control & Distribution Module and provides a convenient central point of distribution. The module also contains filtering circuitry to reduce electro-magnetic interference (EMI). This module accepts standard IEC-C13 and C19 plugs.

The Power Distribution and Control Unit provide secure, remote management of the AC powered equipment and components in the control cabinet via Ethernet connection. The unit allows the operator to control the power (on / off) to the various components in the radar system via Ethernet.

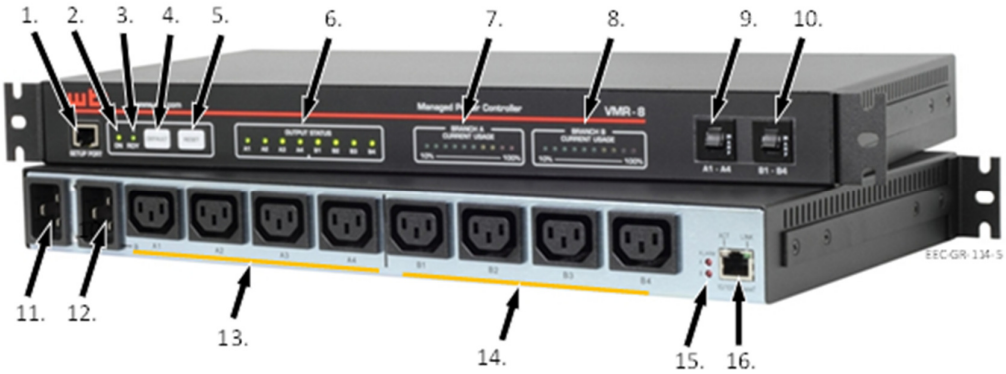

Figure 10. Power Distribution and Control Unit (VMR-8HD20-2)

1. Setup Port
2. ON LED
3. READY LED
4. Default Button
5. Reset Button
6. Output Status Indicators
7. Branch A Current Usage
8. Branch B Current Usage
9. Branch A Circuit Breakers
10. Branch B Circuit Breakers
11. Branch A Power Inlet
12. Branch B Power Inlet
13. Branch A (A1-A4) Power Outlets
14. Branch B (B1-B4) Power Outlets
15. Alarm LEDs
16. Ethernet Connection

1.1.7. Fiber-Optic Coupler (Unit 1 A7)

The SC, 6X Fiber-Optic Coupler (see Error! Reference source not found.) is used for snap-on mounting for fast and easy installation of as many as six fiber-optic connections between the Control Cabinet and the Antenna/Pedestal.

1.1.8. Fiber Optic Media Converter Assembly (Unit 1 A8)

The Fiber-Optic Converter Assembly contains an Ethernet Switch for network access and to convert fiber-optic signal from the Antenna/Pedestal to Ethernet, a 24 VDC Power Supply to supply direct current (DC) power to the Ethernet Hub, and a Fuse Block to protect the critical circuits on the assembly.

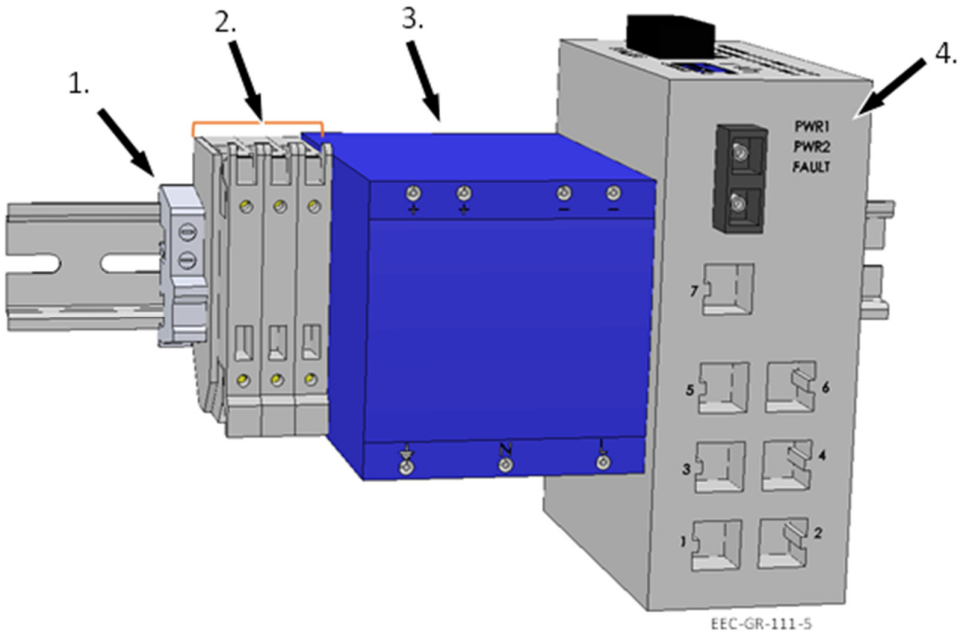

Figure 11. Fiber Optic Media Converter Assembly (133116-100)

1. Terminal Block End Stop (CA702)
2. Fuse Block (3 Each), (CAFL4U)
3. Power Supply, 24 VDC (DPP100-24)
4. Ethernet Switch, 7-Port, 1 FO (EDS-308-M-SC-T)

1.1.8.1. 7-Port Ethernet Switch with 1-Fiber Optic Port (Unit 1 A8 A1)

The Ethernet Switch with Fiber-Optic Media Converter provides network access to the RCU computer for the Analog and Discrete Input Modules and converts a fiber-optic connection to Ethernet. The fiber-optic connection extends Ethernet connectivity to the Antenna/Pedestal.

1.1.8.2. 24VDC Power Supply (Unit 1 A8 PS1)

The 24 VDC power supply provides power to the 7-Port Ethernet Switch. See also paragraph 1.1.10.4.

1.1.9. UPS, 2000/1800 KVA (Unit 1 A9)

The 2KVA Uninterruptable Power Supply (UPS) provides adequate power for the Control Cabinet. The 2KVA UPS provides backup power and line conditioning for the all components in the Control Cabinet.

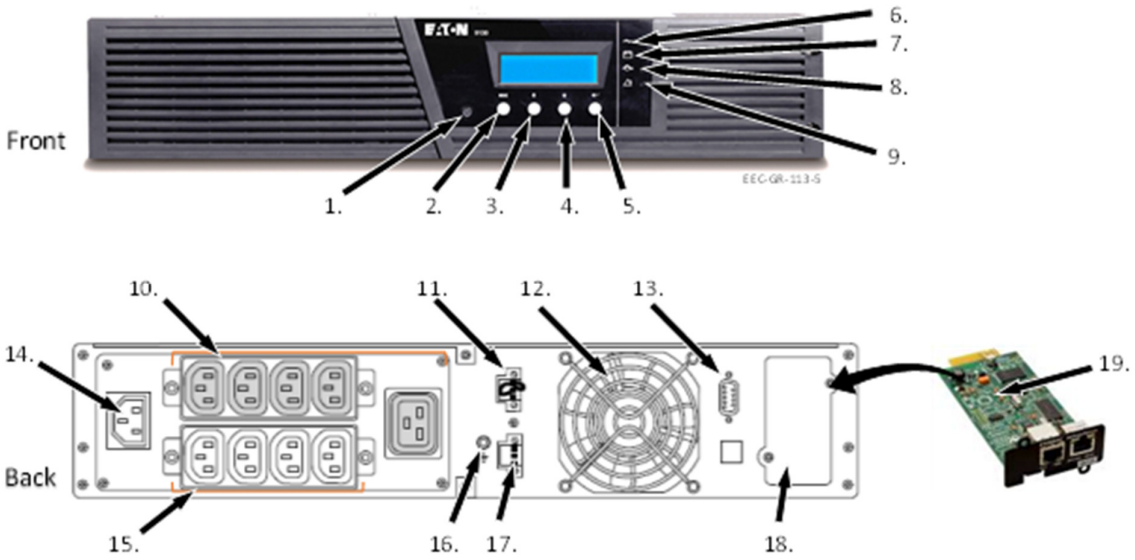

Figure 12. UPS, Powerware Model 9130, (PW9130I2000R-XL)

1. On / Off Button
2. Escape Button
3. UP Button
4. DOWN Button
5. Enter Button
6. Power Indicator (Green)
7. On Batter Indicator (Yellow)
8. Bypass Indicator (Yellow)
9. Alarm Indicator (Red)
10. Power Output Segment 1
11. Remote Power Off (REPO)
12. Cooling Fan
13. RS232 Connection
14. Power Input
15. Power Output Segment 2
16. Ground Connection
17. Standard Relay Output Contact
18. Communication Bay
19. SNMP Card (Ethernet)

The UPS will power the Ranger-X5 for up to 15 minutes. External (optional) battery packs can extend the operational time of the UPS and Ranger-X5.

1.1.10. DC Power Distribution Plate (Unit 1 A10)

A proprietary power control system and industry-standard AC/DC power supplies are installed in the Control Cabinet. This includes a 48VDC power supply and a 24VDC power supply. DC Power is transmitted from the Control Cabinet to the pedestal through shielded cable and the FOSR (Fiber-Optic Slip Ring) system.

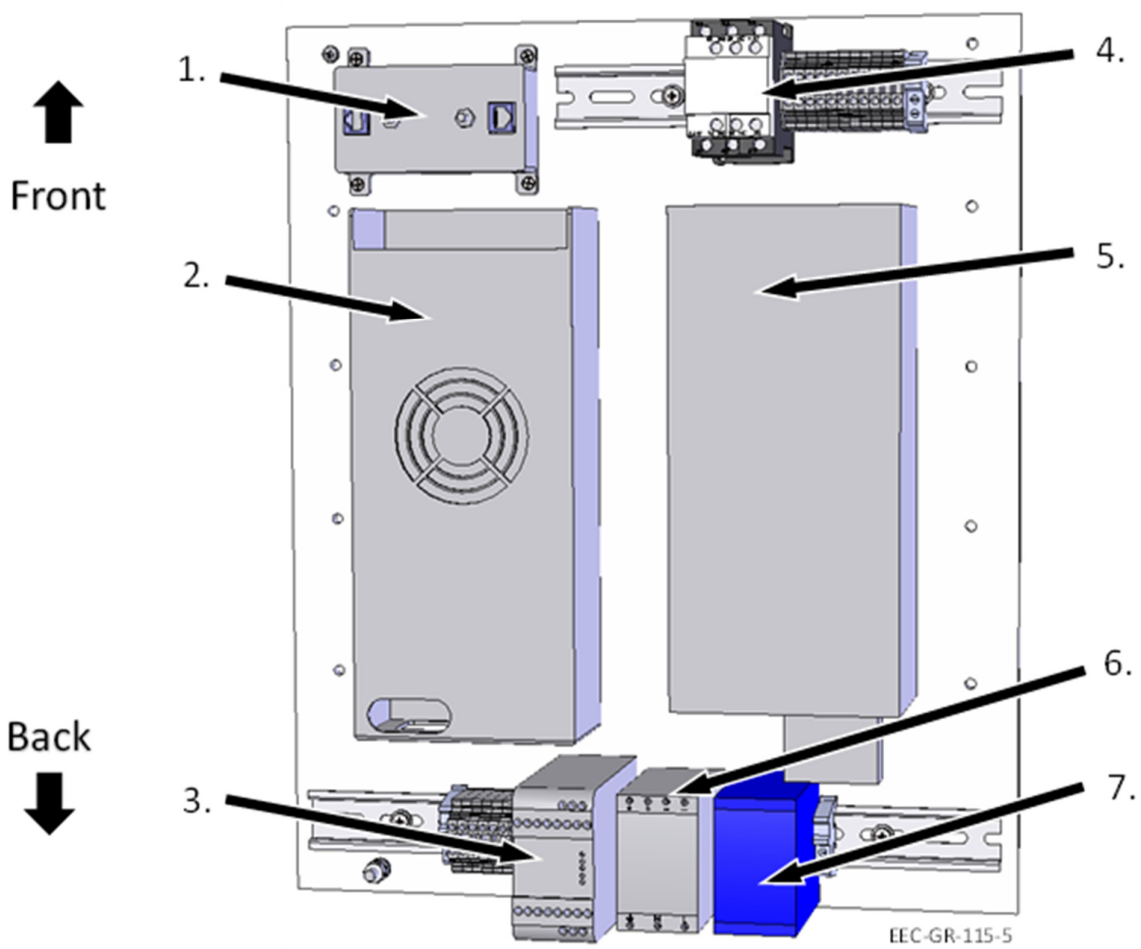

Figure 13. DC Power Distribution Plate (134932-101)

1.	Lightning Protect Module (A1) - HGLN-CAT6-HP
2.	Power Supply, 600W, 24V (PS3) – GEM600-24G
3.	Safety Relay (K2) – RT6-24VDC
4.	3-Phase Contactor, 24VDC (K1) – 226-0516
5.	Power Supply, 48VDC, 32A, (PS2) – RSP1500-48
6.	Power Supply, 24VDC (PS1) – DPP50-24
7.	Power Supply, 12VDC (PS4) – DPP30-12

1.1.10.1. Lightning Protection Module (Unit 1 A10 A1)

(See **Figure 13**, Point 1)

The lighting protection module protects the main Ethernet input from outside the Ranger-X5 radar system.

1.1.10.2. Contactor, 3-Phase, 24VDC (Unit 1 A10 K1)

(See **Figure 13**, Point 4 and **Figure 14**)

The Contactor (K1) receives DC power from the Safety Replay (K2). When DC power is not available, the Contactor (K1) is open (Normally Open) it removes all AC power to the remaining power supplies on the DC Power Distribution Plate. This ensures the power in the pedestal is off and the system stops radiating and the antenna stops moving.

Figure 14. Contactor (226-0516)

1.1.10.3. Safety Relay (Unit 1 A10 K2)

(See **Figure 13**, Point 3)

The Safety Relay (K2) receives DC power from the 24VDC Power Supply (PS1). The Safety Relay receives command and control to open or close DC power output to the Contactor (K1) from the E-Stop Control Switches on the E-Stop Panel (Unit 1 A12) and/or on the Pedestal Plate Enclosure Assembly (Unit 2 A1 A5).

When an E-Stop Button is depressed, the Safety Relay stops sending DC power to the Contactors (K1) and it opens. When the Contactor (K1) is open, it removes all AC power to the remaining DC Power Supplies (PS2, PS3, and PS4).

Figure 15. Safety Relay (RT6-24VDC)

1.1.10.4. 24VDC Power Supply (Unit 1 A10 PS1)

(See **Figure 13**, Point 6)

The 24VDC Power Supply (PS1) is outside of the control of the Emergency Stop System. PS1 provides power to the Safety Replay (RT6), which in turn, controls the AC power supply to the other DC Power Supplies (PS2, PS3, and PS4).

1.1.10.5. 48VDC Power Supply (Unit 1 A10, PS2)

(See **Figure 13**, Point 5)

The 48VDC Power Supply (PS2) provides all the 48VDC voltage for the Antenna / Pedestal Assembly.

1.1.10.6. 24VDC Power Supply, 600W, 27A Peak (Unit 1 A10 PS3)

(See **Figure 13**, Point 2)

The 24VDC Power Supply (PS3) provides all the 24VDC voltage for the Antenna / Pedestal Assembly.

1.1.10.7. 12VDC Power Supply (Unit 1 A10 PS4)

The 12VDC Power Supply (PS4) provides all the 12VDC voltage for the Antenna / Pedestal Assembly.

(See **Figure 13**, Point 7)

1.1.11. E-Stop Panel (Unit 1 A11)

The E-Stop Control panel contains the E-Stop Reset button, the E-Stop Button, Power Indicators, and two Circuit Breakers. The Main Power circuit breaker (CB1) controls power to the entire system. The Pedestal Power circuit breaker (CB2) controls the power to the DC Power Distribution Plate (see paragraph 1.1.10).

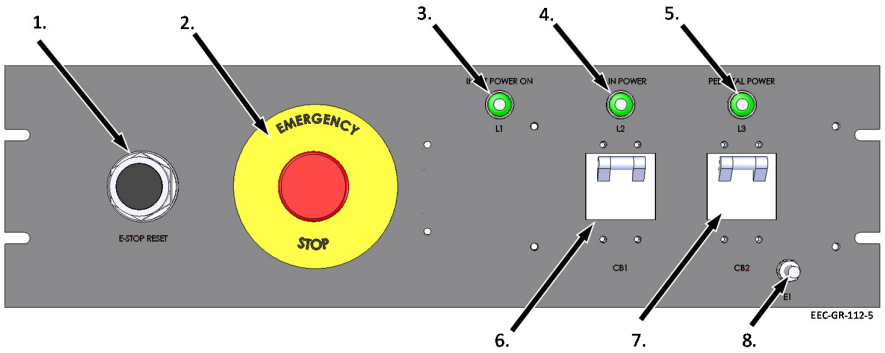

Figure 16. Emergency Stop Panel (134933-100)

1.	E-Stop Reset Button (2XVT5)	
2.	E-Stop (704-0742) (704-9631) (704-9104)	Button
3.	Input Power LED – L1 (679-9774)	
4.	Main Power LED – L2 (679-9774)	
5.	Pedestal Power LED – (679-9774)	
6.	Circuit Breaker – Main – 50A (683-0035)	
7.	Circuit Breaker – Pedestal – 10A (683-0037)	

1.1.12. I/O Panel Assembly (Unit 1 A12)

The Indoor Control Cabinet is equipped with an I/O Panel Assembly to connect the Control Cabinet to the Pedestal Unit. The AC Input for the Outdoor Control Cabinet is through a standard, commercial grade circuit breaker box.

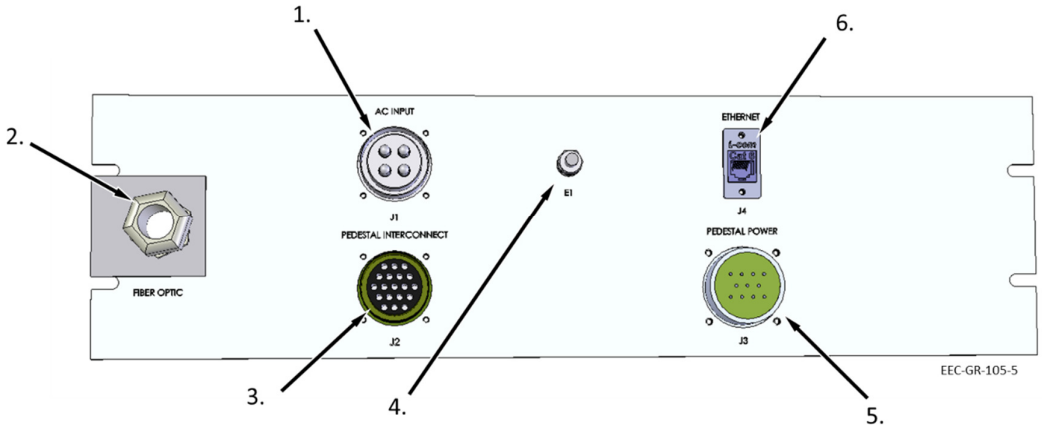

Figure 17. I/O Panel Assembly, 19-inch Rack (134938-100)

1. AC Power IN (not used)
2. Fiber Optic Cable Gland
3. Pedestal Communication Interconnect
4. Ground Connection Point
5. Pedestal Power Interconnect
6. Ethernet Connection

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