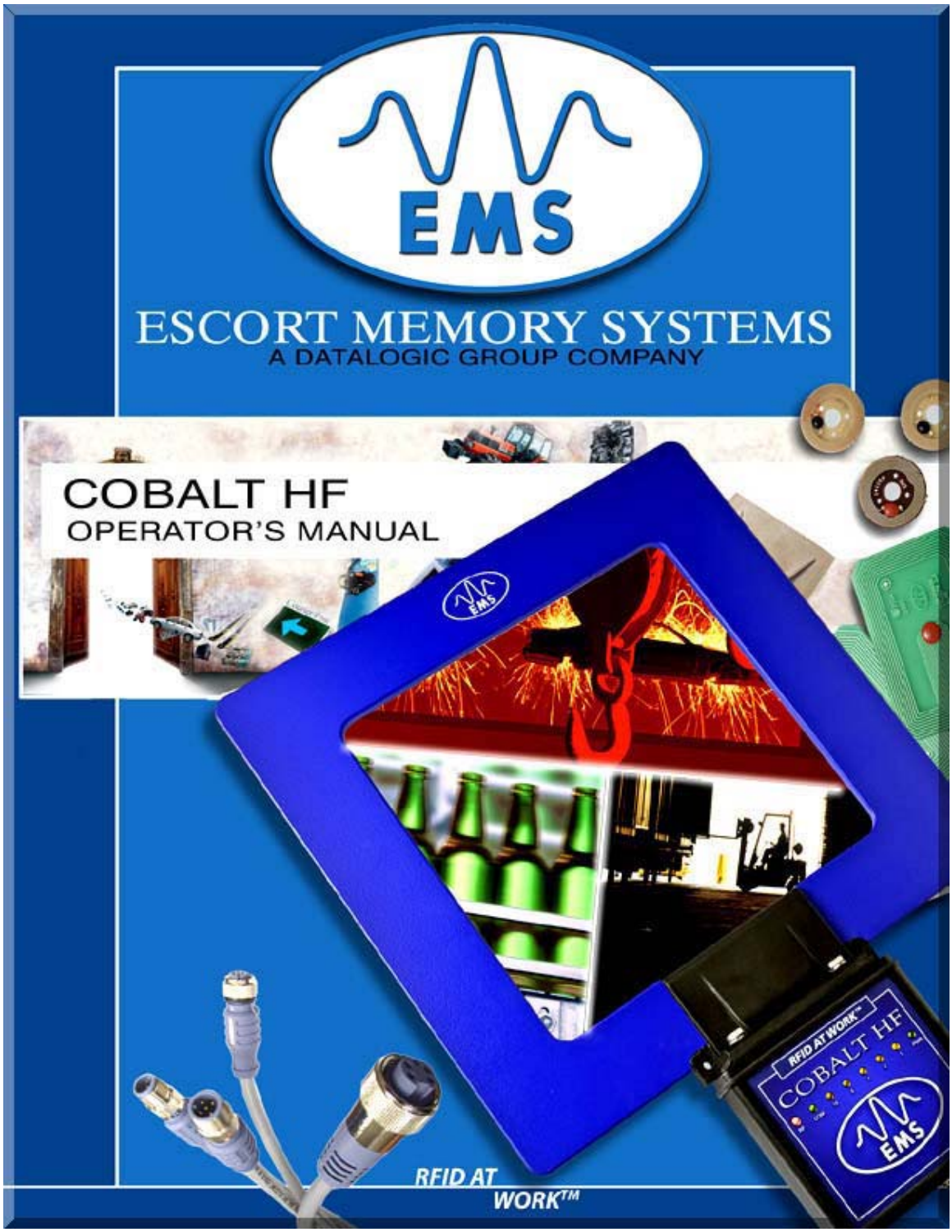
EMS
ESCORT MEMORY SYSTEMS
A DATALOGIC GROUP COMPANY
COBALT HF
OPERATOR'S MANUAL
RFID AT WORK™
COBALT HF
EMS
RFID AT WORK™

ESCORT MEMORY SYSTEMS

COBALT HF

RFID CONTROLLERS

High Frequency Passive Radio Frequency Identification Controllers

For the Cobalt HF Series of RFID Controllers:

- **HF-CNTL-232-01**
- **HF-CNTL-422-01**
- **HF-CNTL-485-01**
- **HF-CNTL-USB-01**
- **HF-CNTL-IND-01**

OPERATOR'S MANUAL

How to Install, Configure and Operate

Escort Memory Systems'

Cobalt HF RFID Controllers

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Cobalt HF RFID Controllers - Operator's Manual

P/N: 17-1320 REV 01 (03-06)

FCC & CE COMPLIANCE NOTICE

FCC PART 15.105

This equipment has been tested and found to comply with the limits for a Class A 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 uses, generates, and can radiate radio frequency energy and, if not installed and used in accordance with these 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 dealer or an experienced radio/TV technician for help.

FCC PART 15.21

Users are cautioned that changes or modifications to the unit not expressly approved by Escort Memory Systems may void the user's authority to operate the equipment.

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 that may cause undesired operation.

This product complies with CFR Title 21 Part 15.225.

CE

This product is compliant to CE requirements and has been tested and complies with EN-300-330, EN-300-683, EN 60950, IEC 68-2-1, IEC 68-2-6, IEC 68-2-27 and IEC 68-2-28.

TELEC

This product has been certified under:
Regulations for Enforcement of the Radio Law Article 6, section 1, No. 1

Certification #: ***PENDING***

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CHAPTER 1: GETTING STARTED

1.1 INTRODUCTION

Welcome to the **Cobalt HF RFID Controllers - Operator's Manual**. This manual will assist you in the installation, configuration and operation of the Cobalt HF RFID Controllers.

The Cobalt HF family is a complete line of feature-rich, passive high frequency read/write Radio-Frequency Identification devices that provide RFID data collection and control solutions to shop floor, item-level tracking and material handling applications. They are designed to be compact, rugged and reliable, in order to meet and exceed the requirements of the industrial automation industry.

1.1.1 Company Background

Escort Memory Systems has long been an industry leader in providing Radio Frequency Identification devices and has built a solid reputation by consistently delivering an extended selection of quality, durable industrial grade RFID products.

1.1.2 About this Manual

This manual provides guidelines and instructions for installing and operating the Cobalt HF RFID Controller. Included are descriptions of the RFID command set and examples demonstrating how to issue commands to the Cobalt HF RFID Controller.

Numbers expressed in Hexadecimal notation, are prefaced with "**0x**"**.** For example, the number **ten** in decimal is expressed as **0x0A** in hexadecimal. See Appendix D for a chart containing Hex values up to 0x7F, their corresponding ASCII characters and decimal integer equivalents.

1.2 FEATURES OF THE COBALT CONTROLLER

- High performance, industrial, multi-protocol RFID controller
- Supports communication interface protocols: Subnet16™, Commercial TCP/IP, Ethernet/IP™ and Modbus® TCP
- Interface Options: RS232, RS422, RS485, USB and Ethernet
- Reads/Writes ISO 14443A, ISO 15693 and Philips® I•CODE® 1 tag ICs and compliant RFID tags
- Compatible with HMS-Series and LRP-Series RFID tags from Escort Memory Systems
- Supports Escort Memory Systems' ABx Fast & CBx™ command protocols
- Internationally recognized ISM frequency of 13.56 MHz.
- Rugged IP66 rated housing
- 8 LED status indicators for power, COM Activity, RF Activity, Subnet16 Node ID, system diagnostics and error codes
- Flash memory for software upgrades
- Auto configurable and software programmable
- Unique serial ID number on every controller
- FCC/CE/TELEC agency compliance certification

1.3 COBALT CONTROLLER MODELS

There are five models of the Cobalt HF RFID Controller. Each model is designed to support a specific communication interface option. The table below lists the five controller models, their respective connection types and communication interfaces.

1.3.1 Connections & Communication Interface Options

COBALT CONTROLLER MODEL	CONNECTION TYPE	COMMUNICATION INTERFACE	MAX CABLE LENGTH
HF-CNTL-232-01	RS232	Point-to-Point, Host/Controller	15m
HF-CNTL-422-01	RS422	Point-to-Point, Host/Controller	300m
HF-CNTL-485-01	RS485	Multidrop (Subnet16) Bus Architecture	300m
HF-CNTL-USB-01	USB	Point-to-Point, Host/Controller	3m
HF-CNTL-IND-01	Ethernet	TCP/IP, Ethernet/IP, Modbus TCP	100m

Table 1-1: Connections & Communication Interface Options

1.3.2 Cobalt Controllers - Interface Connectors

CONTROLLER MODEL	INTERFACE CONNECTOR(S)
HF-CNTL-232-01	8-pin Male M12 connector for power and data
HF-CNTL-422-01	8-pin Male M12 connector for power and data
HF-CNTL-485-01	5-pin Male M12 connector for power and data
HF-CNTL-USB-01 (2 connectors)	5-pin Male M12 connector for power
	5-pin Female M12 reverse keyed connector for data
HF-CNTL-IND-01 (2 connectors)	5-pin Male M12 connector for power
	4-pin Female M12 D-Code connector for data

Table 1-2: Cobalt Controllers - Interface Connectors

1.4 CONTROLLER DIMENSIONS

1.4.1 Dimensions for HF-CNTL-232/422-01 Models

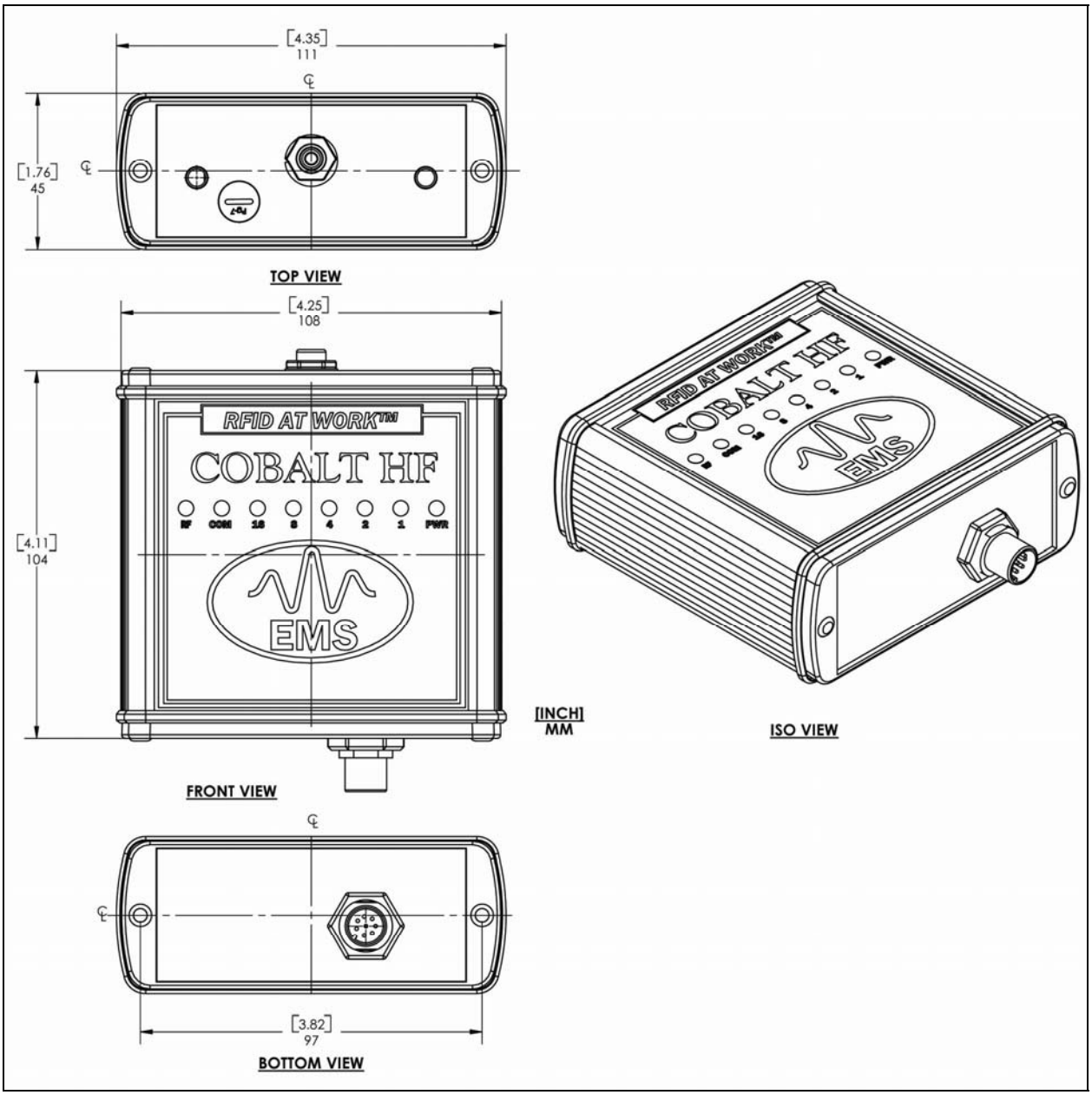


Figure 1-1: HF-CNTL-232/422-01 Dimensions

1.4.2 Dimensions for HF-CNTL-485-01 Model

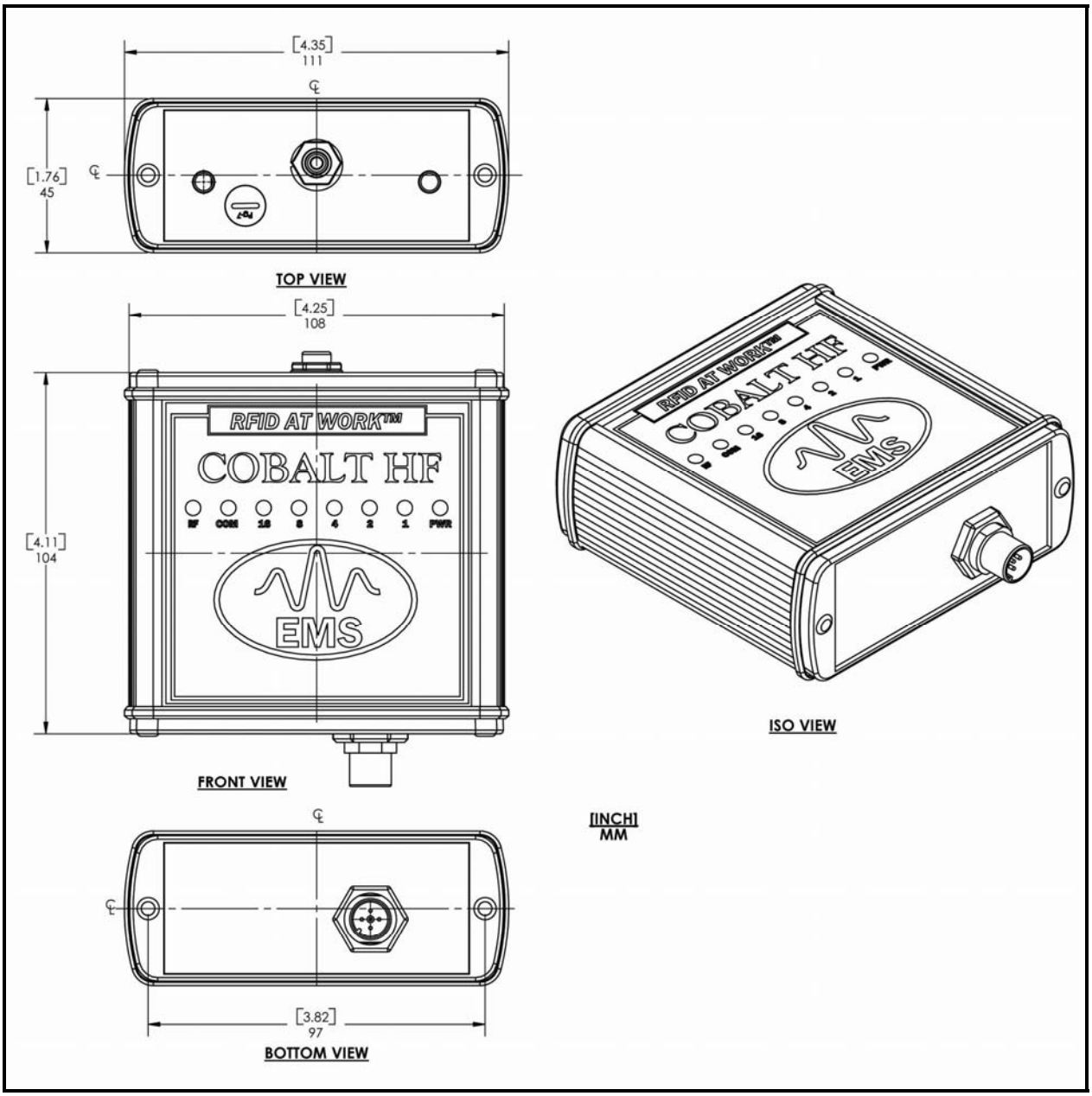


Figure 1-2: HF-CNTL-485-01 Dimensions

1.4.3 Dimensions for HF-CNTL-USB/IND-01 Models

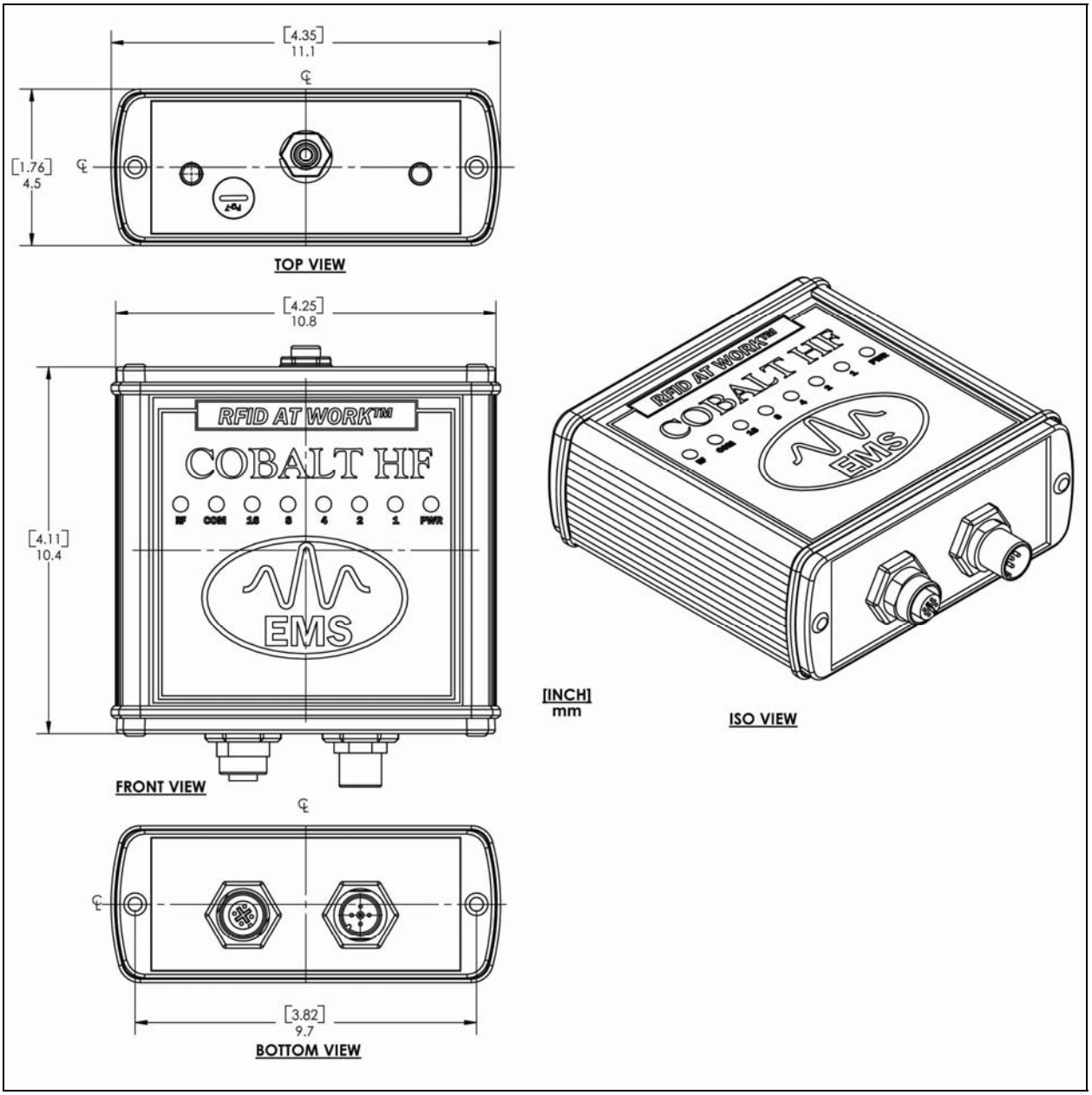


Figure 1-3: HF-CNTL-USB/IND-01Dimensions

1.5 COBALT HF ANTENNAS

The Cobalt HF family currently includes four different RFID antennas (three of which are pictured below). Because the Cobalt Antennas are designed with different dimensions, they each generate a different size RF field and read/write range.

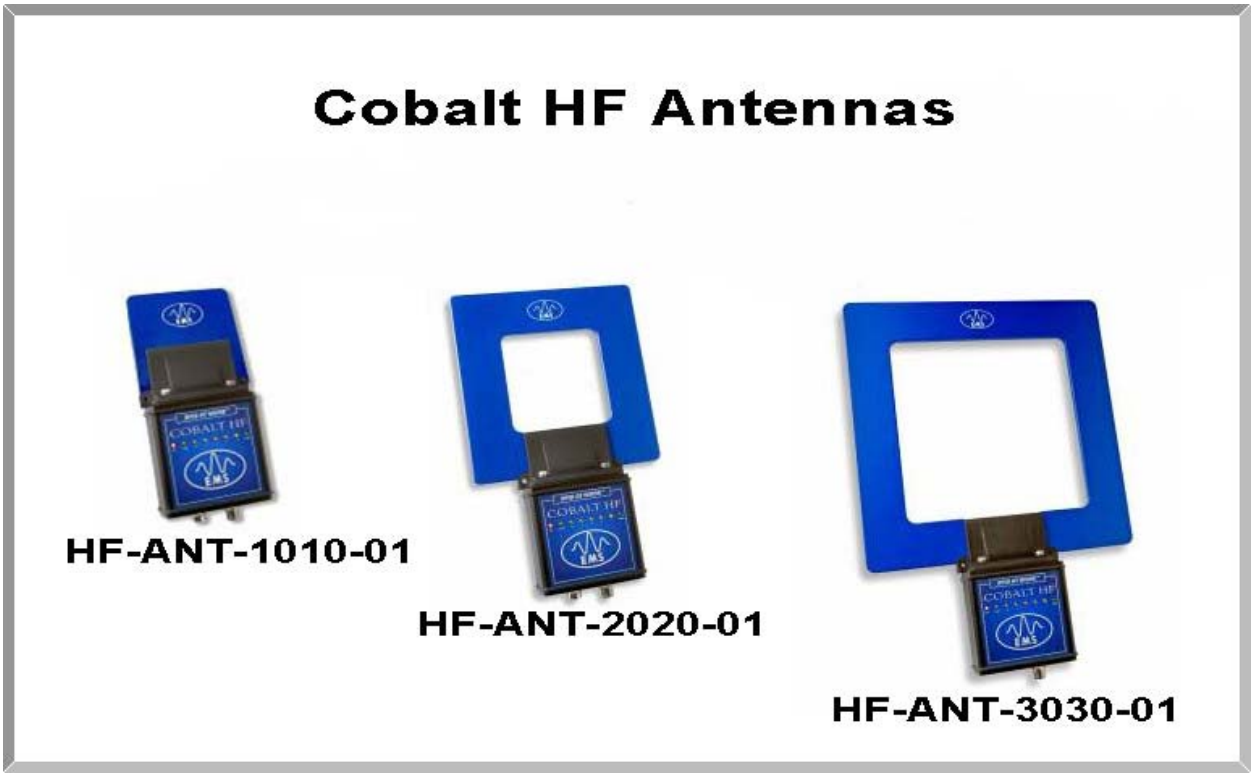


Figure 1-4: Controllers with HF-ANT-1010-01, HF-ANT-2020-01 and HF-ANT-3030-01 Antennas

1.5.1 Cobalt HF Antennas – Models and Sizes

ANTENNA MODEL	ANTENNA SIZE
HF-ANT-1010-01	10cm x 10cm
HF-ANT-2020-01	20cm x 20cm
HF-ANT-3030-01	30cm x 30cm
HF-ANT-0750-01	7cm x 50cm

Table 1-3: Cobalt HF Antennas – Models and Sizes

1.5.2 Antenna to Tag Ranges

COBALT ANTENNA TO TAG RANGE TABLE

Tag range values are listed in millimeters and inches (**mm / in**.).

EMS TAG	ANT-1010	ANT-2020	ANT-3030	ANT-0750	TESTING ENVIRONMENT
LRP125(HT)	152 / 6.0	203 / 8.0	228 / 9.0	*Pending*	Free Air
LRP125(HT)S	152 / 6.0	216 / 8.5	228 / 9.0	*Pending*	Free Air
LRP250(HT)	178 / 7.0	267 / 10.5	305 / 12.0	*Pending*	Free Air
LRP250(HT)S	267 / 10.5	381 / 15.0	406 / 16.0	*Pending*	Free Air
LRP-P3858	216 / 8.5	292 / 11.5	343 / 13.5	*Pending*	Free Air
LRP-P3858S	216 / 8.5	292 / 11.5	343 / 13.5	*Pending*	Free Air
HMS125(HT)	64 / 2.5	64 / 2.5	Not Advised	*Pending*	Free Air
HMS-P138	127 / 5.0	178 / 7.0	178 / 7.0	*Pending*	Free Air
HMS150(HT)	127 / 5.0	183 / 7.2	165 / 6.5	*Pending*	Free Air
LRP525HTS	254 / 10.0	381 / 15.0	432 / 17.0	*Pending*	Attached to Metal
LRP525S	216 / 8.5	318 / 12.5	356 / 14.0	*Pending*	Attached to Metal

Table 1-4: Antenna to Tag Ranges

ATTENTION

The tag range values listed above are provided for design purposes. Range can be adversely affected by many environmental factors including metal, moisture and liquids. Testing should be performed in the actual environment for more precise range results.

See table below for tag ICs and memory capacities.

EMS TAG IC AND MEMORY CAPACITY

The following table lists the integrated circuit (IC) and memory size of each Escort Memory Systems' LRP and HMS-Series RFID tag included in the *Antenna to Tag Range* table above.

EMS TAG	TAG IC	MEMORY SIZE
LRP125(HT)	I•CODE 1	48-bytes + 8-byte ID
LRP125(HT)S	I•CODE 2 (SLi)	112-bytes + 8-byte ID
LRP250(HT)	I•CODE 1	48-bytes + 8-byte ID
LRP250(HT)S	I•CODE 2 (SLi)	112-bytes + 8-byte ID
LRP525(HT)S	I•CODE 2 (SLi)	112-bytes + 8-byte ID
LRP525S	I•CODE 2 (SLi)	112-bytes + 8-byte ID
LRP-P3858	I•CODE 1	48-bytes + 8-byte ID
LRP-P3858S	I•CODE 2 (SLi)	112-bytes + 8-byte ID
HMS125(HT)	Mifare Classic	736-bytes + 4-byte ID
HMS-P138	Mifare Classic	736-bytes + 4-byte ID
HMS150(HT)	Mifare Classic	736-bytes + 4-byte ID

Table 1-5: EMS Tag IC and Memory Capacity

1.5.3 Connecting the Antenna to the Controller

Cobalt HF Antennas mount directly to the top of the Cobalt HF RFID Controller's housing. The antenna is first attached to the RF port on the controller and is then fastened to the controller's housing with the two M5 screws and matching lock washers included with each Cobalt HF RFID Controller. Carefully use the provided 4mm hex key wrench to tighten both M5 screws per the torque specification below:

ANTENNA MOUNTING TORQUE SPECIFICATION

Torque Specification for the two M5 screws that hold the antenna to the controller:

1.7 Nm or 15 lbs per inch ± 10%

1.6 COBALT HF ANTENNA DIMENSIONS

1.6.1 HF-ANT-1010-01 Antenna Dimensions

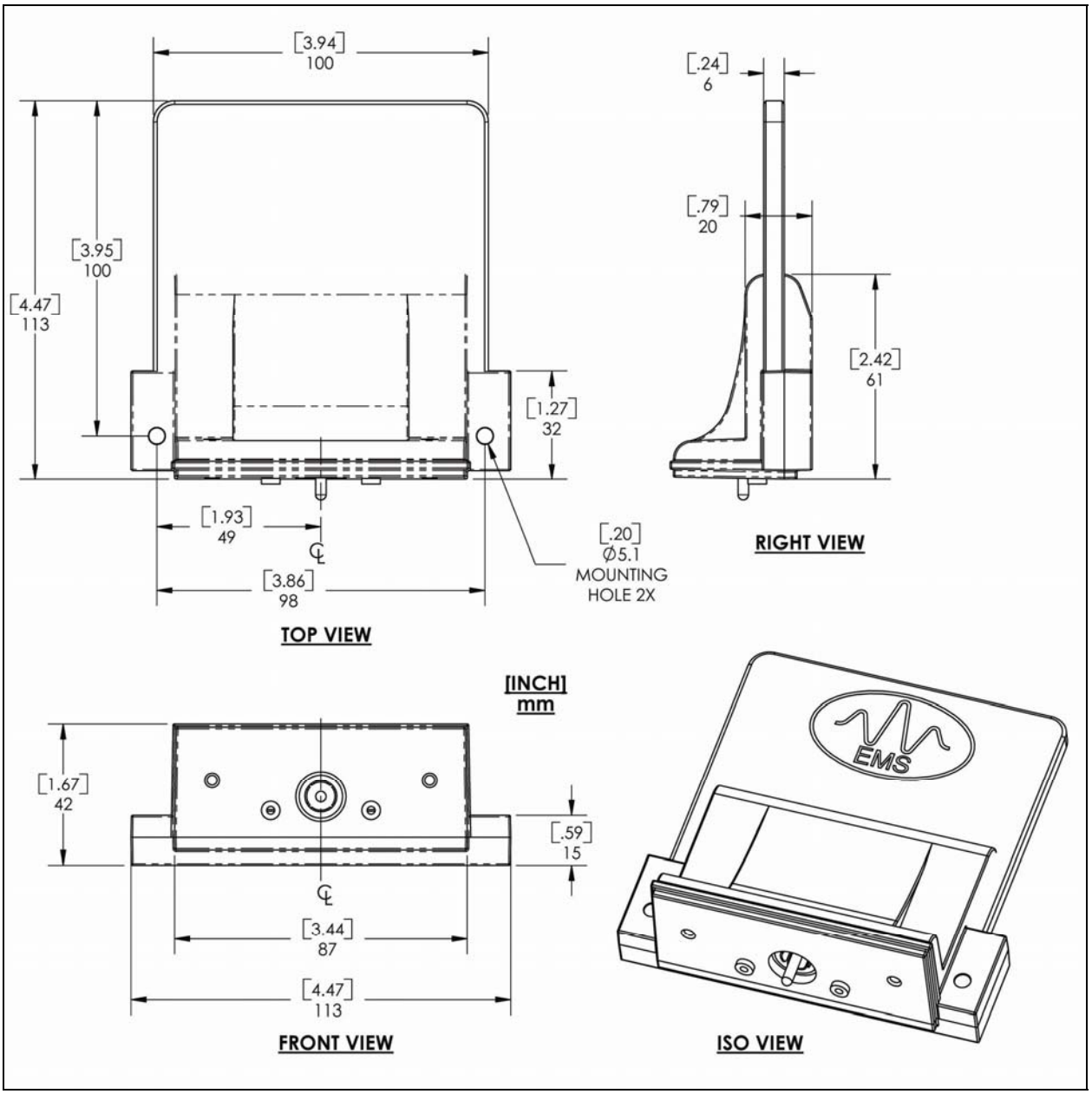


Figure 1-5: HF-ANT-1010-01 Antenna Dimensions

1.6.2 HF-ANT-2020-01 Antenna Dimensions

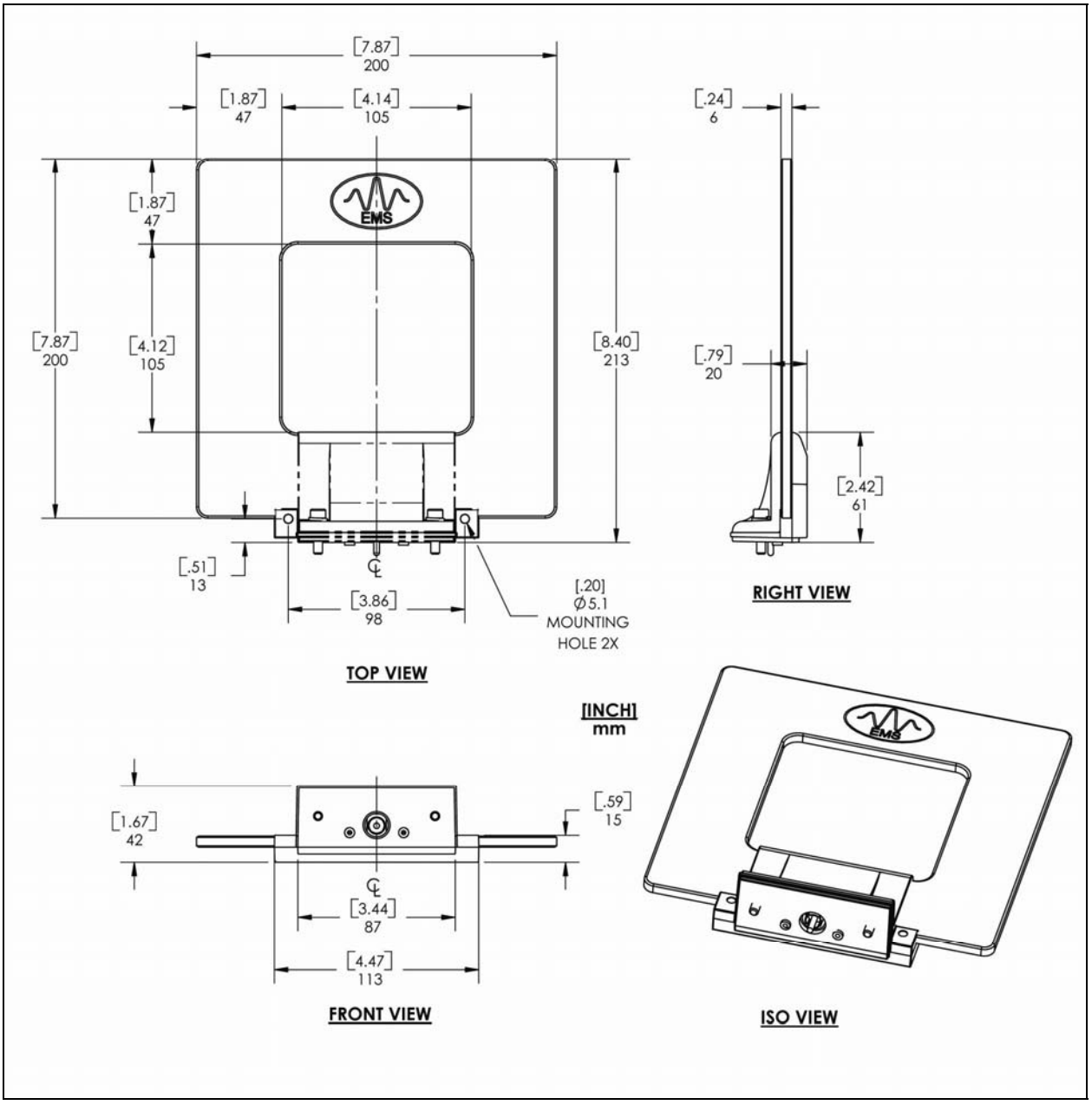


Figure 1-6: HF-ANT-2020-01 Antenna Dimensions

1.6.3 HF-ANT-3030-01 Antenna Dimensions

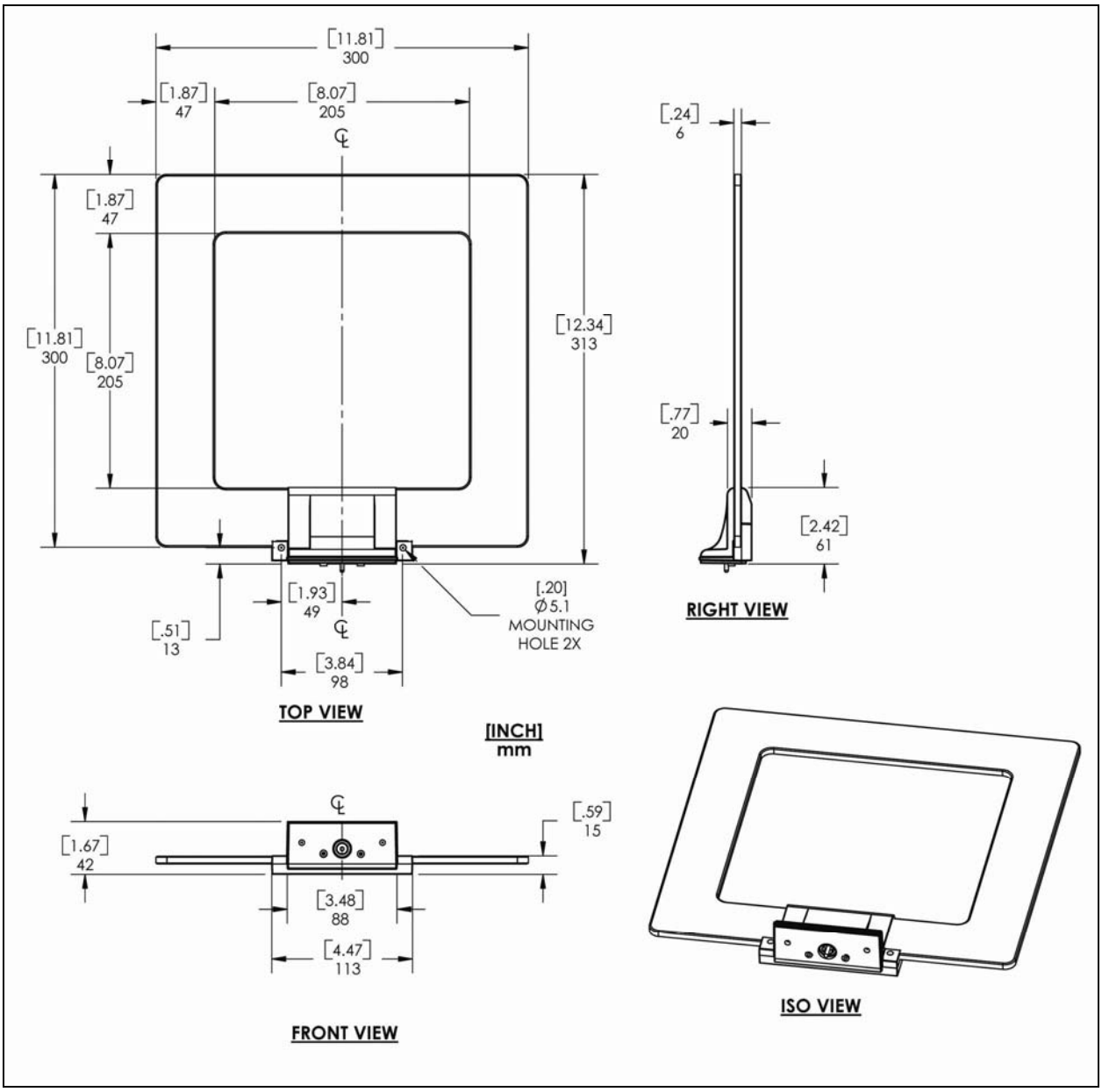


Figure 1-7: HF-ANT-3030-01 Antenna Dimensions

1.6.4 HF-ANT-0750-01 Antenna Dimensions

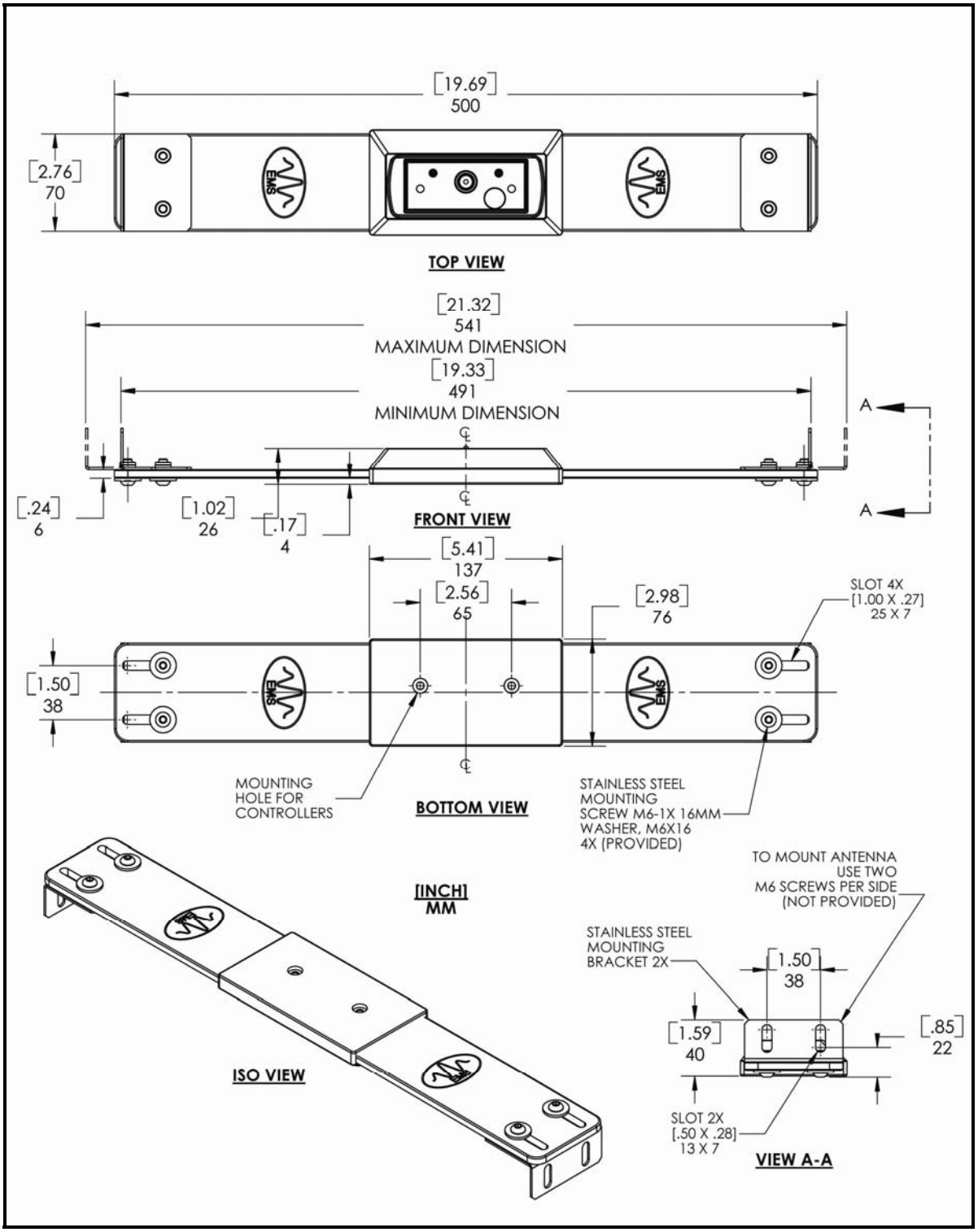


Figure 1-8: HF-ANT-0750-01 Antenna Dimensions

1.7 RFID OVERVIEW

The Cobalt HF-series products are designed for use with passive RFID tags. Passive tags require no batteries and are energized by the magnetic field of the Cobalt HF controller's antenna. Through *inductive coupling*, power is induced from the controller's antenna into the antenna of the RFID tag. Similar to a transformer, the efficiency of the energy transferred is a result of the size and number of turns on the transmit antenna (primary winding) and size and number of turns on the tag's antenna (secondary winding). The resonant frequency of each antenna coil and its Q-factor (quality factor) are primary design concerns for efficient antenna coil and tag coil designs.

Optimum tuned coils for both the antenna and tag will achieve the best energy transfer. The Q-factor defines how wide of bandwidth the energy is spread over. The RF output power is fixed within the legal limits, the higher the peak energy at the resonant frequency the higher the Q value and the narrower the bandwidth. Inversely, the lower the peak energy at the resonant frequency the lower the Q value and the wider the bandwidth. Higher the Q values of the two antenna coils will produce the greatest range. However the with too high a Q value the less tolerant the system will be of shifts of the resonant frequency. The lower the Q value, the wider the bandwidth and the greater tolerance the system will have to shifting of the resonant frequency.

Tuned antenna circuits are affected by virtually all materials, whether they are metal, water, plastic, cement or even the human touch. Some materials will shift the resonant frequency up, and other materials will shift the frequency down and some have more affect than others. Metal and water will have the most serious affect on antenna tuning, metal more so than water. The lower the frequency the less affect metal and water have on the performance. The 13.56MHz HF frequency provides the best compromise between range, speed, and immunity to environmental affects. The HF-series products are designed with optimum antenna designs with Q values required for most applications.

The Cobalt HF-series operates at the ISM (Industrial, Scientific, Medical) internationally accepted frequency of 13.56MHz. 13.56MHz is considered to be in the High Frequency spectrum as opposed to 864MHz or 915MHz which fall under the Ultra-High Frequency or UHF spectrum, or 2.4GHz in the microwave range spectrum. For reference, 13.56MHz falls between the AM and FM radio bands.

Understanding these principals is important when considering the mounting of the HF Controller's antenna and the RFID tag. Unless the tag or antenna is designed specifically for mounting close to metal, non-metallic mounting brackets and non-metallic tag spacers are required to achieve optimum read and write ranges.

Electrical noise generated by motors, conveyors and other automation equipment can produce excessive electrical noise which can negatively affect the RF communications. The Cobalt HF series products should only be used on well grounded systems. Conveyors systems should be tied directly to earth ground by an electrician. All cables used on and around the RFID system must be shielded cables. Cable shields should typically be grounded at both ends, however, differences in ground potentials can produce "ground loops" and in those cases the ground connection may need to be lifted at one end of the cable.

The range performance specified in this and other Escort Memory Systems publications refer to the free air measurement, meaning there is no metal in the field. Because the proximity to metal and other environmental conditions affect read and write range, it is impossible for Escort Memory Systems to state the absolute range that will be achieved

in for all conditions. The system integrator must validate the performance as the products are to be used and can not rely solely on the published range specifications.

The Cobalt HF RFID Controller is compatible with Escort Memory Systems LRP and HMS series RFID tags. HMS series tags are referred to as proximity whereas the LRP series are referred to as vicinity tags and have longer range. HMS tags utilize ISO 14443A integrated circuits while the LRP series utilize Philips ICODE1 and ISO15693 integrated circuits manufactured by Phillips, Fujitsu, and Infineon. The Cobalt HF-series is also capable of reading other ISO15693 compliant tags.

For more information on RFID tags, see Chapter 5: RFID Tags.

1.8 SUBNET16™ MULTIDROP PROTOCOL

The HF-CNTL-485-01 model includes support for Escort Memory Systems' Subnet16™ Multidrop RFID networking protocol. Under the Subnet16 protocol, up to 16 HF-CNTL-485-01 RFID Controllers can be connected via a trunk and tap network to an Industrial Ethernet Subnet16™ Gateway (GWY-01-IND-01) or TCP/IP Subnet16™ Gateway (GWY-01-TCP-01) interface module.

HF-CNTL-485-01 models can also be connected directly to an Industrial Ethernet Subnet16™ Hub (HUB-04-IND-01) or TCP/IP Subnet16™ Hub (HUB-04-TCP-01) interface module. The Subnet16™ Hubs have four independent controller ports, four digital inputs and four digital outputs.

Figure 1-9: Industrial Ethernet Subnet16™ Gateway and Hub

CHAPTER 2: COBALT INSTALLATION

2.1 UNPACK & INSPECT THE CONTROLLER

Unpack the Cobalt Controller hardware and accessories. Retain the original shipping carton and packing material in case an item needs to be returned. Inspect each piece carefully, if an item appears to be damaged, notify your Escort Memory Systems product distributor.

2.1.1 Package Contents

The Cobalt HF RFID Controller product package contains the following components:

PART NUMBER	QUANTITY	DESCRIPTION
HF-CNTL-*XXX*-01	1	Cobalt HF Series RFID Controller
17-312*X*	1	HF-CNTL-*XXX*-01 - Installation Guide
20-1950	2	Antenna Mounting Screws (M5 x 20mm, Hex #4, Stainless Steel)
20-3915	2	Spring Washers for Antenna Mounting Screws (M5, Stainless Steel)
69-1289	1	Tool - Hex #4 (4mm L-Key)
00-3000	1	Cobalt HF Series - Configuration Tag
CBL-1487	1	Field Mountable 5-Pin Female M12 Connector for Power Connection (USB and IND Models).

XXX = Model Designation (232, 422, 485, USB or IND)

Table 2-1: Cobalt Controller - Package Contents

2.1.2 Providing the Power

Cobalt Controllers require an electrical supply voltage of 10~30VDC and have a power consumption of 12W (450mA @ 24VDC).

Employ a regulated power supply that is capable of delivering these requirements. Below is a list of power supplies available from Escort Memory Systems.

COBALT HF RFID CONTROLLERS - POWER SUPPLY PART NUMBERS

- **00-1166**: (24VDC, 1.88A max, 45W)
- **00-1167**: (24VDC, 4.17A max, 100W)
- **00-1168**: (24VDC, 5.0A max, 120W)

2.2 INSTALLATION PRECAUTIONS

RF performance and read/write range can be negatively impacted by the proximity of metallic objects. Avoid mounting the antenna within 15cm (6 inches) of any metallic object or surface.

2.2.1 Installation Guidelines

- Do not route cables near unshielded cables or near wiring carrying high voltage or high current. Cross cables at perpendicular intersections and avoid routing cables near motors and solenoids.
- Avoid mounting the Cobalt Controller near sources of EMI (electro-magnetic interference) or near devices that generate high ESD (electro-static discharge) levels.
- In the event that electrical interference is encountered (as indicated by a reduction in read/write performance) try relocating the controller to an area away from the potential source of interference.
- Plan to perform a test phase where you will construct a small scale, independent network that includes only the essential devices required to test your RFID application. To avoid possible interference with other devices, avoid connecting your RFID testing environment to an existing local area network.
- The Cobalt HF Controller is designed to withstand 8kV of direct electro-static discharge (ESD) and 15kV of air gap discharge. However, it is not uncommon for some conveyor applications to generate considerably higher ESD levels. Use adequate ESD prevention measures to dissipate potentially high voltages.

2.2.2 Minimum Distance between Antennas

When using multiple Cobalt HF Controllers/Antennas, maintain the recommended minimum distance between adjacent Cobalt Antennas (*see table below*).

COBALT ANTENNA	1010	2020	3030	0750
1010	60cm	75cm	90cm	50cm
2020	75cm	90cm	1.2m	65cm
3030	90cm	1.2m	2m	90cm
0750	50cm	65cm	90cm	50cm

Table 2-2: Minimum Distance between Antennas

2.3 INSTALLING THE HF-CNTL-232-01

2.3.1 HF-CNTL-232-01 Installation

1. Attach the Cobalt HF Antenna to the Cobalt HF Controller (refer to *Section 1.5.3*).
2. Following the guidelines in *Section 2.2.1*, select a suitable location for the Cobalt HF Controller/Antenna. If necessary, fabricate mounting brackets from durable plastic.
3. Fasten the combined controller and antenna to the mounting fixture using two M5 (#10) diameter screws, each passing through the antenna's mounting holes and secured with locking washers and nuts. Tighten screws to 1.7 Nm or 15 lbs per inch ± 10%.
4. Connect the 8-pin female M12 end of a serial communications cable to the 8-pin male M12 connector on the Cobalt HF-CNTL-232-01.
5. Connect the opposite end of this cable to an available COM port on the host computer (see *Section 2.3.2,* below, for cabling information).
6. Provide a power supply for the controller that is capable of delivering 10~30VDC, 12W.
7. Turn the power supply ON. The green power LED and the yellow Node ID 1 LED will remain lit. The Node ID 1 LED indicates that the controller is in RS232 mode.

2.3.2 HF-CNTL-232-01 Cabling Information

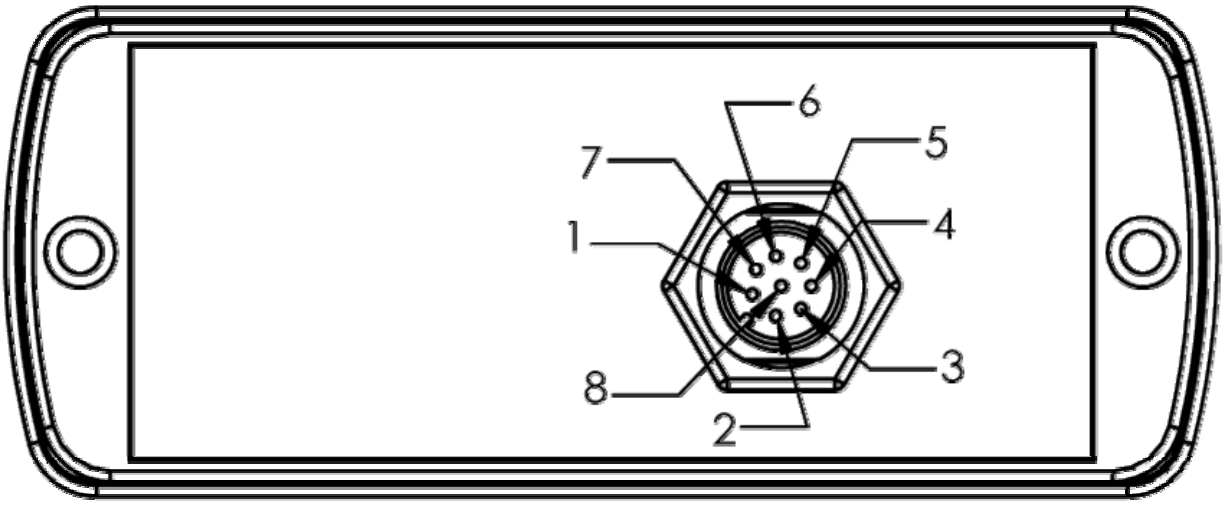


Figure 2-1: HF-CNTL-232-01 – 8-Pin Male M12 Connector

HF-CNTL-232-01 Connector Pin Descriptions

PIN #	DESCRIPTION
1	10~30VDC PWR
2	0VDC (POWER GND)
3	NOT CONNECTED
4	NOT CONNECTED
5	NOT CONNECTED
6	RX
7	TX
8	SGND (SIGNAL GROUND)

Table 2-3: HF-CNTL-232-01 Connector Pin Descriptions

RS232 Interface Cable Schematic

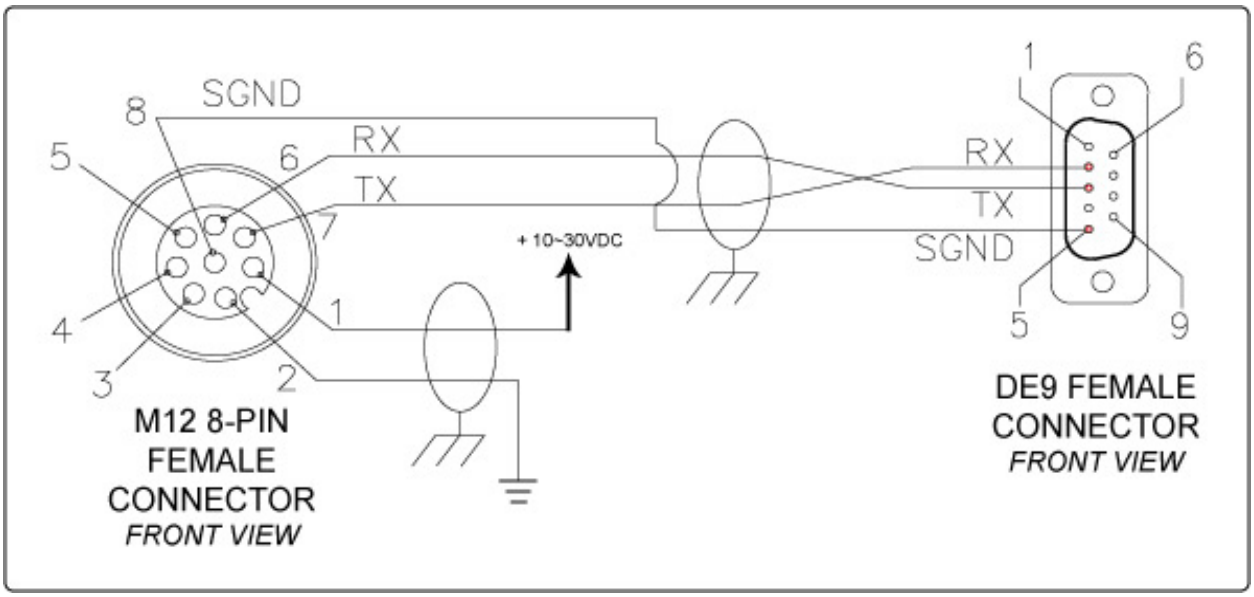


Figure 2-2: RS232 Interface Cable Schematic

HF-CNTL-232-01 DEFAULT COM PORT SETTINGS

COM PORT PARAMETER	DEFAULT SETTING
Baud	9600*
Data Bits	8
Stop Bits	1
Parity	None
Handshaking	None

Table 2-4: HF-CNTL-232-01 Default COM Port Settings

* The Cobalt HF-CNTL-232-01 supports baud rates of 9600, 19.2k, 38.4k, 57.6k and 115.2k.

HF-CNTL-232-01 CABLING PART NUMBERS

- **CBL-1478**: (RS232 Cable, Female, DB9, 2.5mm DC Jack).
- **CBL-1488-XX**: (8-pin, Female M12 w/ Bare Wires).
- **CBL-1491**: (8-pin, Female M12 Right Angle Field Mountable Connector).
- **CBL-1492-XX**: (8-pin, Female M12 Right Angle, Bare Wires).
- **CBL-1493**: (8-pin, Female M12 Straight Field Mountable Connector).
- Recommended Bulk RS232 cable - **Belden P/N: 9941**.

(*XX = Cable Length in Meters*)

2.4 INSTALLING THE HF-CNTL-422-01

2.4.1 HF-CNTL-422-01 Installation

1. Attach the Cobalt HF Antenna to the Cobalt HF Controller (refer to *Section 1.5.3*).
2. Following the guidelines in *Section 2.2.1*, select a suitable location for the Cobalt HF Controller/Antenna. Fabricate mounting brackets from durable plastic, if necessary.
3. Fasten the combined controller and antenna to the mounting fixture using two M5 (#10) diameter screws, each passing through the antenna's mounting holes and secured with locking washers and nuts. Tighten screws to 1.7 Nm or 15 lbs per inch ± 10%.
4. Connect the 8-pin female M12 connector from a serial communications cable to the 8-pin male M12 connector on the Cobalt HF RFID Controller (refer to *Section 2.4.2* below for cabling information).
5. Attach the other end of the serial cable to the RS422 port on the host PC. Follow wiring instructions included with the host RS422 interface.
6. Provide a regulated power supply of 10~30VDC, 12W for the controller.
7. Turn the power supply ON. The green power LED and the yellow Node ID 2 LED will remain ON while power is applied to the unit. The Node ID 2 LED indicates that the controller is in RS422 mode.

2.4.2 HF-CNTL-422-01 Cabling Information

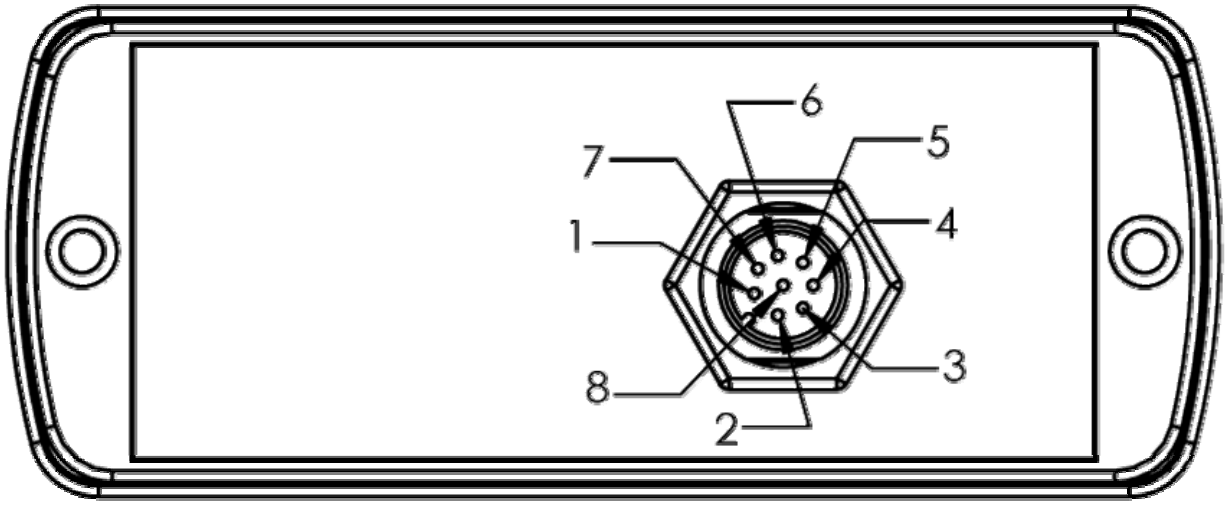


Figure 2-3: HF-CNTL-422-01 - 8-Pin Male M12 Connector

HF-CNTL-422-01 Connector Pin Descriptions

PIN #	DESCRIPTION
1	10~30VDC PWR
2	0VDC (POWER GND)
3	+TX (A)
4	-TX (B)
5	+RX (A)
6	-RX (B)
7	NOT CONNECTED
8	SGND (SIGNAL GND)

Table 2-5: HF-CNTL-422-01 Connector Pin Descriptions

RS422 Interface Cable Schematic

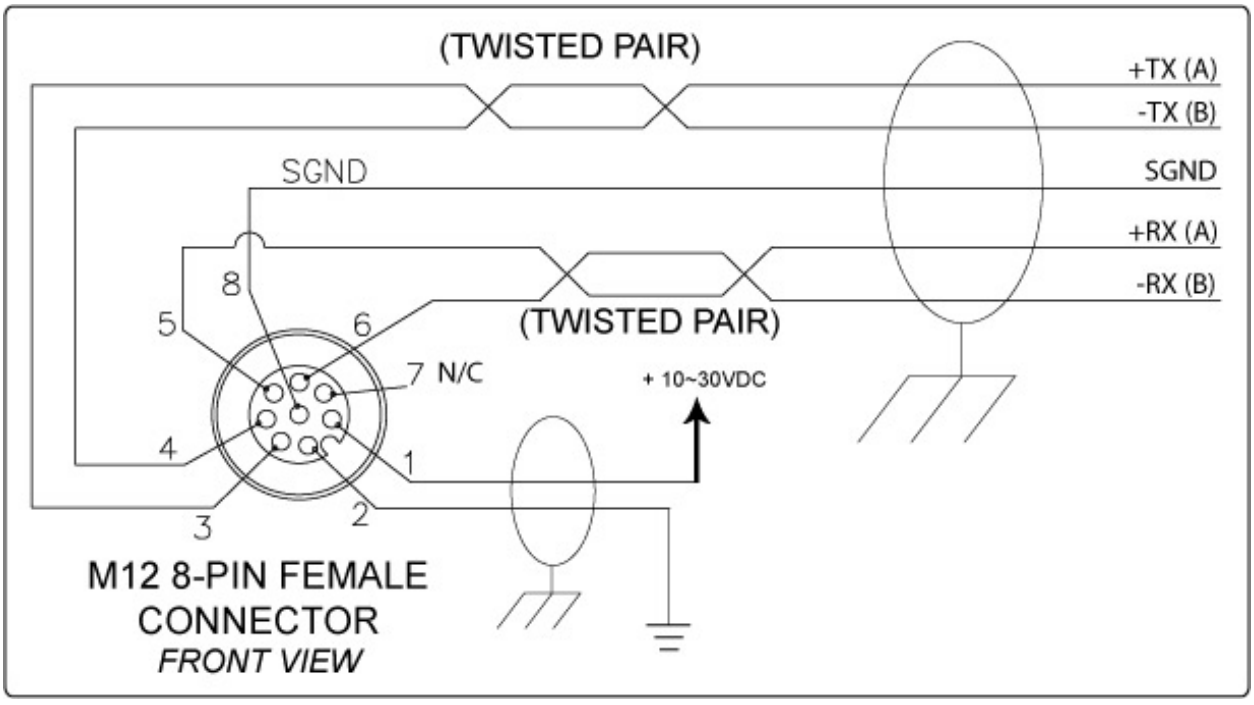


Figure 2-4: RS422 Interface Cable Schematic

HF-CNTL-422-01 COM PORT DEFAULT SETTINGS

COM PORT PARAMETER	DEFAULT SETTING
Baud	9600*
Data Bits	8
Stop Bits	1
Parity	None
Handshaking	None

Table 2-6: HF-CNTL-422-01 COM Port Default Settings

* The Cobalt HF-CNTL-422-01 supports baud rates of 9600, 19.2k, 38.4k, 57.6k and 115.2k.

HF-CNTL-422-01 CABLING PART NUMBERS

- **CBL-1491**: (8-pin, Female, M12 Right Angle Field Mountable Connector)
- **CBL-1493**: (8-pin, Female, M12 Straight Field Mountable Connector)

2.5 INSTALLING THE HF-CNTL-485-01

2.5.1 HF-CNTL-485-01 Installation

1. Attach the Cobalt HF Antenna to the Cobalt HF Controller (*refer to Section 1.5.3)*.
2. Following the guidelines in *Section 2.2.1*, select a suitable location for the Cobalt HF Controller/Antenna. Fabricate mounting brackets from a durable plastic if necessary.
3. Fasten the combined controller and antenna to the mounting fixture using two M5 (#10) diameter screws, each passing through the antenna's mounting holes and secured with locking washers and nuts. Tighten screws to 1.7 Nm or 15 lbs per inch ± 10%.
4. Follow the installation instructions from the Subnet16 Gateway or Subnet16 Hub Operator's Manual. Connect the 5-pin female end of a Subnet cable to the controller's 5-pin male M12 connector. Use only Escort Memory Systems Subnet16 approved cables. (See Appendix B for a complete list of cabling accessories).
5. Provide a regulated power supply of 10~30VDC, 12W for the controller.
6. Turn the power supply ON. The green power LED on the unit will illuminate when power is applied to the unit. The yellow Node ID LEDs, when lit, display the Subnet16 Node ID (in binary) that is currently assigned to the controller. Note: the default Node ID is Node 00; in which case none of the yellow Node ID LEDs will be lit.

Note: the Gateway and Hub Operator's Manuals are available online at www.ems-rfid.com.

2.5.2 HF-CNTL-485-01 Cabling Information

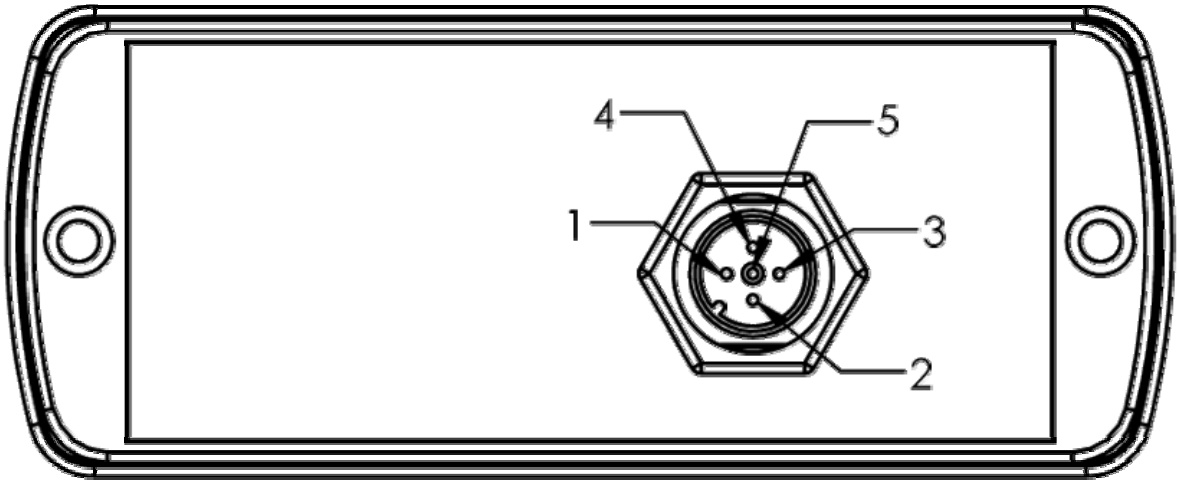


Figure 2-5: HF-CNTL-485-01 – 5-Pin Male M12 Connector

HF-CNTL-485-01 CONNECTOR PIN DESCRIPTIONS

PIN #	DESCRIPTION
1	SIGNAL GND
2	10~30VDC PWR
3	0V (POWER GND)
4	TX/RX+
5	TX/RX-

Table 2-7: HF-CNTL-485-01 Connector Pin Descriptions

2.6 INSTALLING THE HF-CNTL-USB-01

2.6.1 HF-CNTL-USB-01 Installation

1. Attach the Cobalt HF Antenna to the Cobalt HF Controller (refer to *Section 1.5.3*).
2. Following the guidelines in *Section 2.2.1*, select a suitable location for the Cobalt HF Controller/Antenna. Fabricate mounting brackets from a durable plastic if necessary.
3. Fasten the combined controller and antenna to the mounting fixture using two M5 (#10) diameter screws, each passing through the antenna's mounting holes and secured with locking washers and nuts. Tighten screws to 1.7 Nm or 15 lbs per inch ± 10%.
4. Download the Cobalt HF USB driver from the Escort Memory Systems Web site (www.ems-rfid.com). Follow instructions provided with the download to install the USB driver. Do not connect the USB cable at this time.
5. Provide a power supply: 10~30VDC, 12W.
6. Attach the 5-pin female M12 connector from a power supply cable to the 5-pin male M12 connector on the Cobalt Controller.
7. Connect the 5-pin male M12 reverse keyed connector end of the Cobalt HF USB Cable (*CBL-1513*) to the 5-pin female M12 connector on the Cobalt Controller. Do not plug the USB cable into the PC yet.
8. Turn the power supply ON. The green power LED and the yellow LED 4 will remain ON while power is applied to the unit. The LED 4 light indicates that the controller is in USB mode.
9. After the USB drivers are installed and the Cobalt HF Controller completes its boot cycle, plug the remaining end of the USB cable into a USB port on the host PC.

2.6.2 HF-CNTL-USB-01 Cabling Information

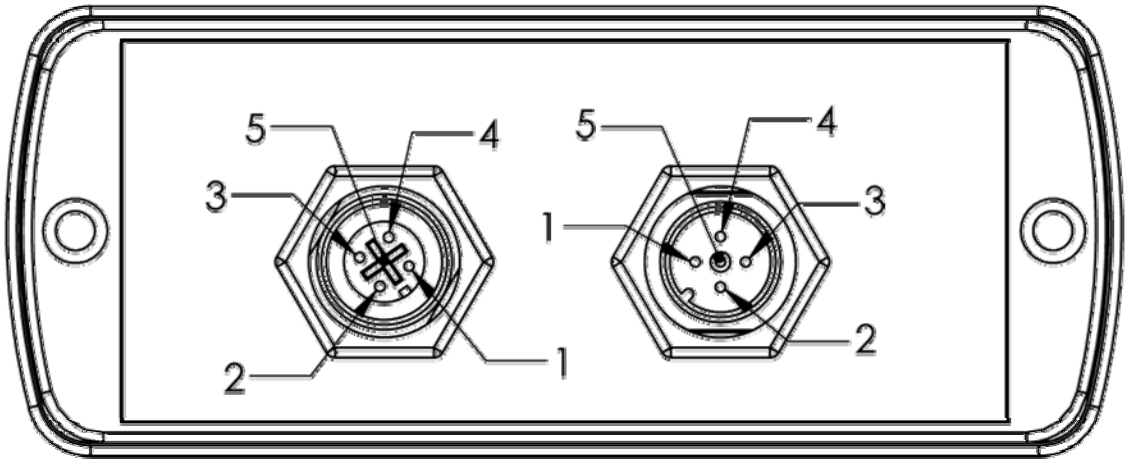


Figure 2-6: HF-CNTL-USB-01 - 5-Pin Female M12 Reverse Keyed & 5-Pin Male M12 Connectors

HF-CNTL-USB-01 – 5-PIN FEMALE RK CONNECTOR: PIN DESCRIPTIONS

PIN #	DESCRIPTION
1	+5V
2	D-
3	D+
4	GND
5	SHIELD

Table 2-8: HF-CNTL-USB-01 – 5-Pin Female RK Connector: Pin Descriptions

HF-CNTL-USB-01 – 5-PIN MALE CONNECTOR: PIN DESCRIPTIONS

PIN #	DESCRIPTION
1	SHIELD GND
2	10~30VDC PWR
3	0V (POWER GND)
4	NOT CONNECTED
5	NOT CONNECTED

Table 2-9: HF-CNTL-USB-01 – 5-Pin Male Connector: Pin Descriptions

HF-CNTL-USB-01 CABLING PART NUMBERS

- **CBL-1513**: (Cable, 5-Pin Male M12, USB, 3M)
- **CBL-1514**: (USB Connector for HF-CNTL-USB-01)

2.7 INSTALLING THE HF-CNTL-IND-01

2.7.1 HF-CNTL-IND-01 Installation

1. Attach the Cobalt HF Antenna to the Cobalt HF Controller (refer to *Section 1.5.3*).
2. Following the guidelines in *Section 2.2.1*, select a suitable location for the Cobalt HF Controller/Antenna. Fabricate mounting brackets from a durable plastic if necessary.
3. Fasten the combined controller and antenna to the mounting fixture using two M5 (#10) diameter screws, each passing through the antenna's mounting holes and secured with lock washers and nuts. Tighten screws to 1.7 Nm or 15 lbs per inch ± 10%.
4. Attach the 5-pin female M12 connector end from a power supply cable to the 5-pin male M12 connector on the Cobalt Controller. The other end of this cable should connect to a regulated power supply capable of delivering 10~30VDC, 12W.
5. Attach the 4-pin male M12 D-Code connector from a CAT 5E (or better) industrial Ethernet cable (CBL-1515-XX) to the 4-pin female D-Code connector on the Cobalt Controller.
6. Connect the other end of the Subnet16 compatible communications cable to an RJ45 interface adapter. Attach the other end from the RJ45 interface adapter to an available Ethernet port on the host PC.
7. Turn the power supply ON. The green power LED on the unit will illuminate. The yellow Node ID 8 LED will be lit when the controller is using its default IP address. The yellow Node ID 16 LED will be lit when the controller is operating with a user defined IP address.

HF-CNTL-IND-01 DEFAULT IP ADDRESS

192.168.253.110

2.7.2 HF-CNTL-IND-01 Cabling Information

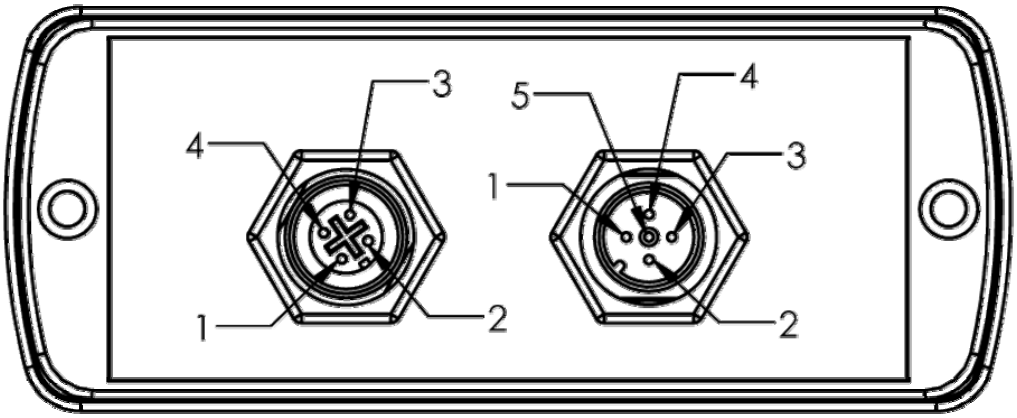


Figure 2-7: HF-CNTL-IND-01 - 4-Pin Female M12 D-Code & 5-Pin Male M12 Connectors

HF-CNTL-IND-01 – 4-PIN CONNECTOR: PIN DESCRIPTIONS

PIN #	DESCRIPTION
1	+ TX
2	+ RX
3	- TX
4	- RX

Table 2-10: HF-CNTL-IND-01 - 4-Pin Connector: Pin Descriptions

HF-CNTL-IND-01 – 5-PIN CONNECTOR: PIN DESCRIPTIONS

PIN #	DESCRIPTION
1	SHIELD GND
2	10~30VDC PWR
3	0V (POWER GND)
4	NOT CONNECTED
5	NOT CONNECTED

Table 2-11: HF-CNTL-IND-01 - 5-Pin Connector: Pin Descriptions

HF-CNTL-IND-01 - CABLING PART NUMBERS

- **CBL-1487**: (Connector, Straight Female, M12, 5-Pin, Field Mountable)
- **CBL-1515-05**: (Cable, 5M, Ethernet/M12, 5-Pin, Male, D-Code)

CHAPTER 3: CONTROLLER CONFIGURATION

Stored in the Cobalt's flash memory is a group of settings and parameters known as the "*Controller Configuration*." These parameters indicate, for example, the Command Protocol in use, the Tag IC to recognize and the software version currently installed.

The Controller Configuration can be modified by using Escort Memory Systems' **RFID Dashboard™** utility or through the use of an **HF-Series Configuration Tag** (included with the Cobalt Controller).

3.1 CONFIGURING THE COBALT VIA RFID DASHBOARD

The **RFID Dashboard** utility is a software application that allows users to view, modify, save and update the configuration settings of their Cobalt Controllers.

Note: there are two versions of the RFID Dashboard: one for serial connections (-232, -422, -USB) and one for TCP/IP connections (-485, -IND).

- Download the appropriate version of the RFID Dashboard from www.ems-rfid.com.
- Follow the instructions included with the software to install the RFID Dashboard and set the Cobalt Controller's configuration.

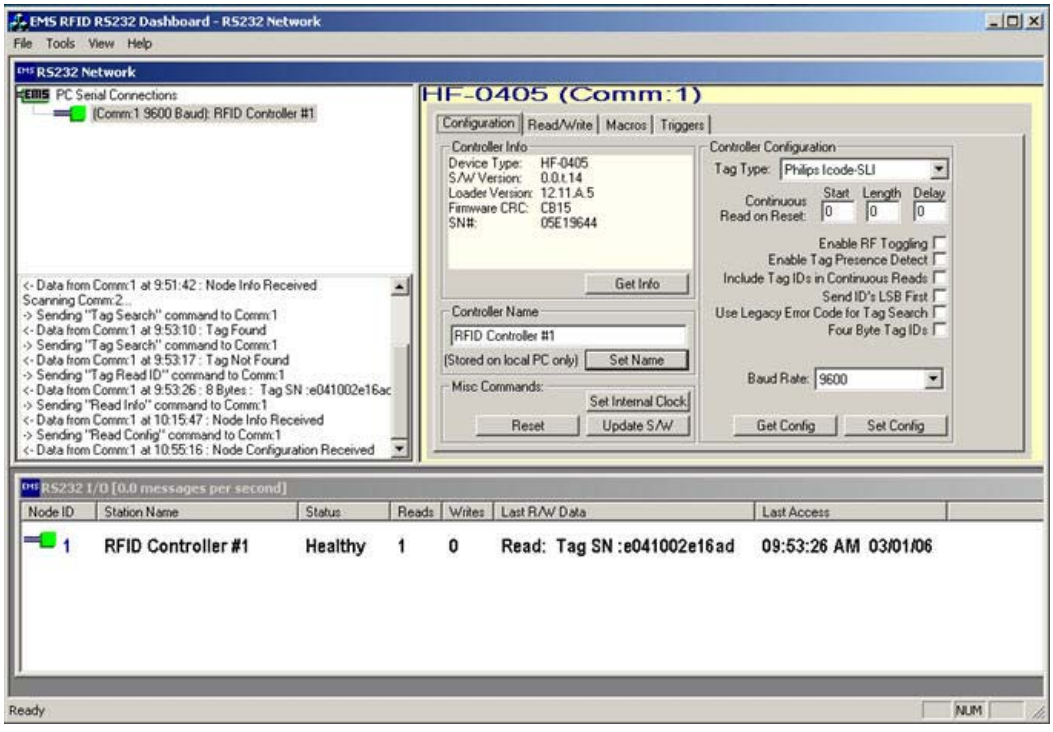


Figure 3-1: RFID Dashboard Utility

3.2 CONFIGURING THE COBALT VIA CONFIGURATION TAG

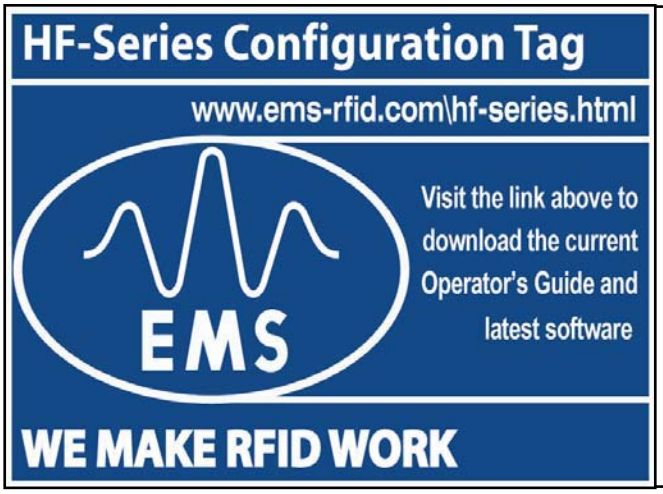
As noted, Cobalt Controllers are software configurable via the RFID Dashboard utility. However, they can also be configured and initialized through the use the **HF-Series Configuration Tag** supplied with each unit.

The Configuration Tag can be used to restore factory default values for all versions of the Cobalt HF RFID Controller. For the Cobalt HF-CNTL-485-01 model, the Configuration Tag can also be used manually to set the controller's Node ID number.

CONFIGURATION TAG MEMORY MAP

The Configuration Tag is a 112-byte ISO 15693 compliant tag. Of the 112 bytes of memory, the first 80 bytes (addresses 0x0000 – 0x0079) are allocated to storing factory data. The first 16 bytes (addresses 0x0000 through 0x0015) are locked because they contain specific data that the controller reads to identify the tag as a Configuration Tag. The remaining 32 bytes (addresses 0x0080 – 0x0111) are not locked and can be written to. All addresses on the Configuration Tag are readable.

NOTE: It is recommended to write your Cobalt product model and serial number on the tag and store it in a safe place.



Configuration Tag – Front

CONFIGURATION TAG INSTRUCTIONS

COBALT 232 or COBALT 422 Models:

- Cycle power or issue reset command (0x35) with this tag in the RF field to reset factory defaults (9600, N, 8, 1, N).

COBALT 485 Models:

- Cycle power or issue reset command (0x35) with this tag in the RF field to reset factory defaults & Node ID to 00.
- Move the tag out of the field and then back into the field to increment the Node ID.
- A Gateway or Hub interface module will auto-assign the next available Node ID to the controller when it is set to Node ID 0, connected to the Subnet16 network, and this tag is brought into the field after power-up.

P/N: 00-3000

Configuration Tag – Back

3.2.1 Restoring Factory Default Settings

Note: read all instructions carefully prior to performing any of the operations below.

To restore factory defaults:

1. Place the Configuration Tag in the antenna's RF field.
2. Reset power to the Cobalt Controller or issue the reset command (*Command 0x35*).
3. Two seconds after power returns to the Cobalt HF, remove the Configuration Tag from the antenna's RF field.

Default settings will be restored and the controller's configuration will be reset. After successfully resetting the controller to factory defaults, the unit will be configured to the following values:

- **Command Protocol:** ABx Fast – without Checksum (-232, -422 and -USB models)
- **Tag Type Recognized:** ISO 15693 (I·Code SLi)
- **Serial Communications:** 9600, N, 8, 1, N (-232 and -422 models)
- **Subnet Node ID:** 00 (-485 model only)
- **IP Address:** 192.168.253.110 (-IND model only)

3.2.2 Manually Assigning Node ID (-485 Only)

1. Place the Configuration Tag in the antenna's RF field and cycle power to the HF-CNTL-485-01controller or issue the reset command (*Command 0x35*). The controller's Node ID number will be reset to the default value of ***00*** (all yellow Node ID LEDs should be off).
2. After power returns to the unit, remove the Configuration Tag from the RF field and then immediately place it back into the RF field once again to increment the Node ID number from ***00*** to ***01***. The Node ID 1 LED should now be lit.

Note that the Node ID number is incremented by one each time the Configuration Tag is withdrawn from and re-introduced to the controller's RF field. This procedure can be used to cycle through all 16 available Node ID numbers. After reaching Node ID 16, incrementing the Node ID value once more returns the controller to Node ID 00.

3. Repeat step 2 until the desired Node ID number is set.
4. Reset power to the unit with the Configuration Tag OUT of RF range. Allow the unit to reset and resume operation under its new Node ID number.

For the -485 model, the lit Node ID LEDs display (in binary) the controller's currently assigned Node ID number. For example, if the Node ID 1, 2 and 4 LEDs are lit, the controller has been assigned Node ID 07. See *Chapter 4: LED Status* for more information regarding the Cobalt's LEDs.

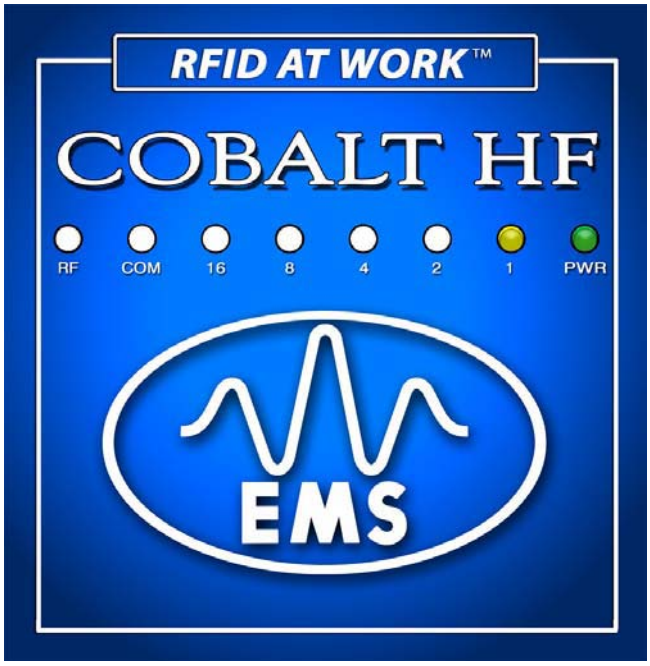


Figure 3-2: Cobalt Controller Set to Node ID 01

3.2.3 Automatic Node Assignment - Subnet16™ Gateway (-485 Only)

Through the use of the Configuration Tag, a ***Subnet16 Gateway*** can automatically assign the Node ID number to a controller connected via Subnet16 network. Follow the steps below to allow a Subnet16 Gateway to automatically assign the Node ID number to a Cobalt HF-CNTL-485-01.

1. With the HF-CNTL-485-01 disconnected from the Subnet16 network, place the Configuration Tag in the antenna's RF field and cycle power to the HF-CNTL-485-01controller.
2. After power returns to the unit remove the Configuration Tag from RF range. Verify that all Node ID LEDs are off - indicating that the controller's Node ID number has been reset to ***00.***
3. Connect the controller to the Subnet16 network and cycle power to the Gateway and Subnet16 network bus.
4. While the Gateway is restarting, place the Configuration Tag in the antenna's RF field. Allow several seconds for the Gateway to recognize the controller and assign it an available Node ID number. Remove the Configuration Tag from RF range.

3.2.4 Automatic Node Assignment - Subnet16™ Hub (-485 Only)

Subnet16 Hubs, which have four independent controller ports, automatically assign each attached RFID controller the corresponding Node ID number of the port to which it is connected. For example, if a controller is attached to port 1 on the Hub, it will be assigned Node ID 01. If a controller with a previously configured Node ID number of 03 is connected to port 2, the Hub will override the controller's current Node ID number and will automatically change it from 03 to 02.

To have the Hub automatically assign the Node ID number to the RFID controller, follow the steps below:

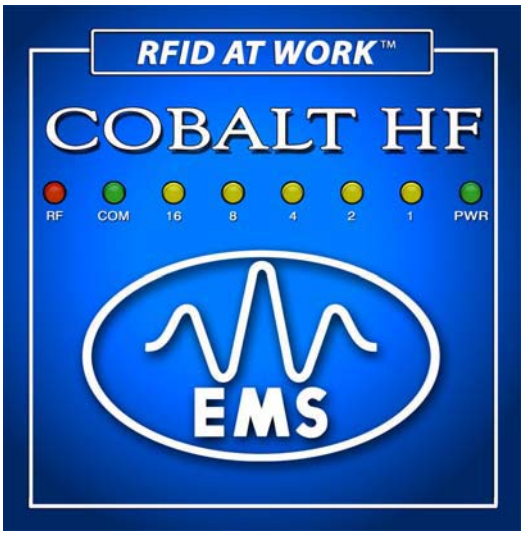
1. Connect the HF-CNTL-485-01 to the Subnet16 Hub
2. Place the Configuration Tag in the antenna's RF field and cycle power to the HF-CNTL-485-01controller.
3. After power returns to the unit, remove the Configuration Tag from RF range. Verify that all Node ID LEDs are off - indicating that the controller's Node ID number has been reset to ***00.***
4. Cycle power to the Hub and Subnet16 network bus.
5. While the Hub is restarting, place the Configuration Tag in the antenna's RF field. Allow several seconds for the Hub to recognize the controller and assign it the corresponding Node ID number of the controller port for which it is attached. Remove the Configuration Tag from RF range.

For more information regarding the Subnet16 Gateway or Hub**,** please refer to the Operator's Manuals of each product - available online at www.ems-rfid.com.

CHAPTER 4: LED STATUS

Cobalt HF RFID Controllers have eight LEDs located on the front panel. These LEDs display RF and communications activity, diagnostic information and power and Node ID status.

4.1 LED DESCRIPTIONS



RF LED, color is red. The RF LED will light when RF power is being transmitted.

COM LED, color is green. The COM (communications) LED indicates that data is being transmitted. Upon receiving a command, the COM LED will begin flashing ON and OFF. After the controller completes the operation and generates a command response, the COM LED flashing will halt.

NODE ID LEDs (x5), colors are yellow (*see table below*).

PWR LED, color is green. The PWR (power) LED will remain ON while power is applied to the Cobalt HF Controller.

NODE ID LED INDICATOR DEFINITIONS

NODE ID LED	DESCRIPTION
Node ID 1	RS232 enabled
Node ID 2	RS422 enabled
Node ID 4	USB enabled
Node ID 8	Default IP Address enabled: 196.169.253.110 (-IND model only)
Node ID 16	Custom IP Address enabled (-IND model only)
All 5 Node ID LEDs	LEDs Display Node ID in binary format (-485 model only)

Table 4-1: Node ID LED Indicator Definitions

4.2 ERROR CONDITIONS

When an error occurs, the red RF LED and one or more yellow LEDs will flash in unison. The yellow LEDs represent the error code in binary notation. These LEDs will continue to flash the error code until a valid command is received by the controller. If an unrecoverable error occurs, the LEDs will continuously flash the error code until the Cobalt Controller has been reset.

See Chapter 8 for a list of error codes and their descriptions.