EBU-xH24XF Base Unit
User Manual

U109.0.0

CERVIS

FCC Statements

15.19 – Two-Part Warning

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference and
- This device must accept any interference received, including interference that may cause undesired operation.

15.21 – Unauthorized Modification

NOTICE: The manufacturer is not responsible for any unauthorized modifications to this equipment made by the user. Such modifications could void the user's authority to operate the equipment.

15.105(b) – 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.

Industry Canada Statement

This device complies with Industry Canada RSS-210.

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/safety-code-6-health-canada-radiofrequency-exposure-guidelines-environmental-workplace-health-health-canada.html.

Le présent appareil est conforme à la norme CNR-210 d'Industrie Canada.

Le programme d'installation de cet équipement radio doit s'assurer que l'antenne est située ou fait telle qu'elle n'émet pas de champ RF dépassant les limites de Santé Canada pour la population générale ; consulter le Code de sécurité 6, disponible auprès de Santé Canada site Web https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/safety-code-6-health-canada- radiofrequency-exposure-guidelines-environmental-workplace-health-health-canada.html.

Industry Canada Statement

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Industry Canada Unlicensed Devices EIRP Statements for Removable Antennas

Part 1: Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Part 2: This radio transmitter (LOBSRF-310) has been approved by Industry Canada to operate with the antenna type listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (LOBSRF-310) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

RoHS Compliance Statement

Cervis, Inc. complies with the requirements of Restriction of Hazardous Substances (RoHS/WEEE) Specification based on in-house practice and declaration of compliance from our vendors. For additional information concerning RoHS compliance, please contact Cervis, Inc. at:

170 Thorn Hill Road ■ Warrendale, PA 15086
Phone: 724.741.9000 ■ Fax: 724.741.9001

This product may contain material that may be hazardous to human health and the environment. In compliance with EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE):

- Do not dispose of the product as unsorted municipal waste.
- This product should be recycled in accordance with local regulations. Contact local authorities for detailed information.
- This product may be returnable to the distributor for recycling. Contact your distributor for details.

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Cervis, Inc. Safety Precautions

- ✓ **Read and follow all instructions.**

- ✓ **Failure to abide by Safety Precautions may result in equipment failure, loss of authority to operate the equipment, and personal injury.**

- ✓ **Use and maintain proper wiring. Follow equipment manufacturer instructions. Improper, loose, and frayed wiring can cause system failure, equipment damage, and intermittent operation.**

- ✓ **Changes or modifications made to equipment not expressly approved by the manufacturer will void the warranty.**

- ✓ **Owner/operators of the equipment must abide by all applicable Federal, State, and Local laws concerning installation and operation of the equipment. Failure to comply could result in penalties and could void user authority to operate the equipment.**

- ✓ **Make sure that the machinery and surrounding area is clear before operating. Do not activate the remote control system until certain that it is safe to do so.**

- ✓ **Turn off the handheld remote and remove power from the base unit before attempting any maintenance. This will prevent accidental operation of the controlled machinery.**

- ✓ **Power can be removed from the Base Unit by detaching the 12-pin cables from the base unit connectors A, B, C and D, or by removing the source power from the circuit.**

- ✓ **Use a damp cloth to keep units clean. Remove mud, concrete, dirt, etc. after use to prevent obstructing or clogging the buttons, levers, wiring, and switches.**

- ✓ **Do not allow liquid to enter the handheld or base unit enclosures. Do not use high pressure equipment to clean the handheld remote or base unit.**

- ✓ **Disconnect the radio base unit before welding on the machine. Failure to disconnect the base unit may result in destruction of or damage to the base unit.**

- ✓ **Operate and store units only within the specified operation and storage temperatures defined in the specifications of this document.**

- ✓ **Keep high-energy RF devices away from handheld remotes. Activation of high-power communication radios, for instance, in close proximity to handheld remotes can result in interference and "false" circuit activation.**

- ✓ **Do not key 2-way radios while using the handheld remote.**

1.0   SmaRT EBU-xH24XF Base Unit Introduction

The versatile EBU-xH24XF base units feature an H-Bridge, sixteen FET (field effect transistor) high-side switching outputs or switch-to-ground digital inputs, two Form C relays, and CAN Bus control capability. Using Direct Sequence Spread Spectrum (DSSS) wireless technology at 900MHz or 2.4GHz, the base unit provides a robust link with a SmaRT handheld remote in congested radio environments. It accepts a broad range of input power with operating voltages ranging from 7VDC to 28VDC. The rugged weatherproof enclosure allows these units to operate worry free in harsh weather conditions. Four 12-wire color-keyed weatherproof connecting cables connect the controlled devices.

SmaRT base units feature seamless communications association to SmaRT handheld remotes without the need to open either the handheld remote or base unit

2.0   Features

- **DSSS Technology (900MHz @ 10mW or 2.4GHz @ 100mW)**

- **Quad Connectors for Ease of Wiring with Power on Each Connector**

- **Sixteen FET Outputs/Inputs**
- **Eight Current Sense Channels**
- **H-Bridge**
- **Power Cutoff FET**
- **Two Form C Relays**

- **Weatherproof**
- **CAN Bus Capable**
- **Five Diagnostic LEDs**
- **Two Analog Outputs**
- **Four Analog Inputs**

EBU-xH24XF-INT   EBU-xH24XF-EXT

Figure 1. SmaRT EBU-xH24XF Base Unit

3.0   EBU-xH24XF LEDs

The EBU-xH24XF has five status/system LEDs that indicate the current state of the active base unit and can be used for troubleshooting when necessary. These LEDs are defined in Table 1.

Table 1. EBU-xH24XF LEDs

| LED	Name	Color	Indication
1	CAN TX/RX	RED	CAN Transmit only active
		GREEN	CAN Receive only active
		AMBER	CAN TX/RX active flashes per message
2	Out/In	GREEN	Outputs only active
		RED	Inputs only active
		AMBER	Outputs and inputs active
3	Health	GREEN	Flash 1/s when health OK
4	RF TX/RX	RED	RF Transmit only active
		GREEN	RF Receive only active
		AMBER	RF TX/RX active flashes per message
5	Power	AMBER	OK when amber
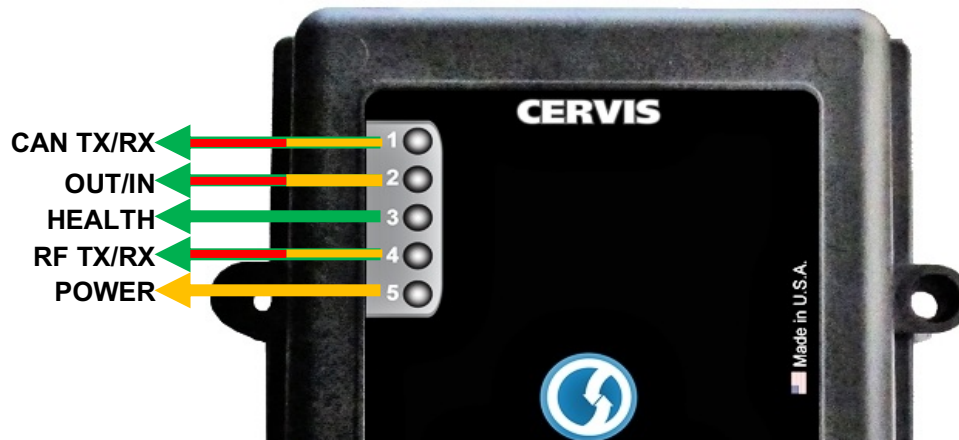
Table 2. EBU-xH24XF LEDs

4.0 EBU-xH24XF Mounting

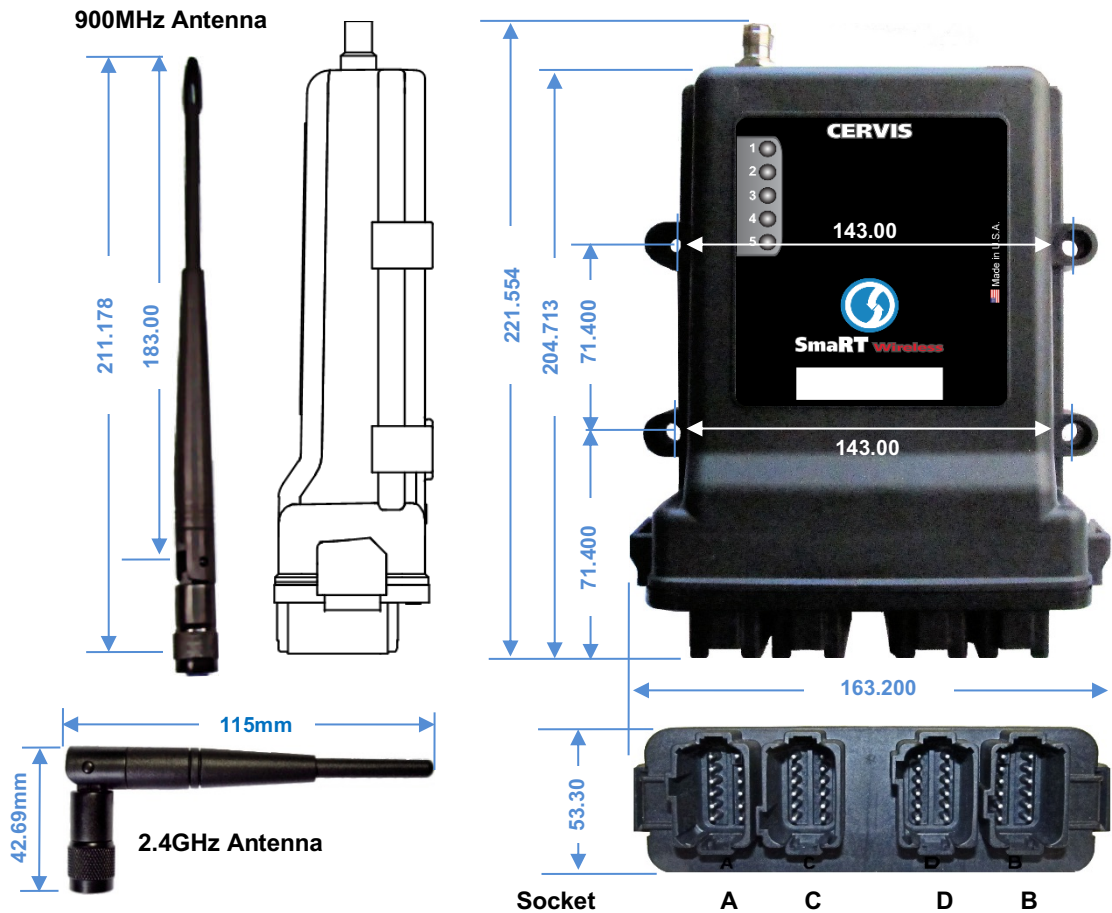The EBU-xH24XF can be mounted using the four mounting holes on the sides of the EBU.

Figure 2. EBU-xH24XF Mounting Dimensions

5.0 EBU-xH24XF Wiring

5.1 Harnesses HN-1026 and HN-1027

The EBU-xH24XF has four 12-pin connector sockets listed as **A, C, D**, and **B** as shown in Figure 2. Cable harness HN-1026 and HN-1027 are typically used to plug into the appropriate sockets of the EBU-xH24XF and then wired to the necessary individual outputs.

- Harness **HN-1026** (Figure 3) has a gray 12-pin plug that connects to **EBU socket A** and a green 12-pin plug that connects to **EBU socket C**. The ≈90 inch (total, connector to lead ends) cable harness contains the combined 24-wires ending with 24 individually numbered ≈6 inch flying leads for wiring to appropriate outputs.

- Harness **HN-1027** (Figure 4) has a brown 12-pin plug that connects to **EBU socket D** and a black 12-pin plug that connects to **EBU socket B**. The ≈90 inch (total, connector to lead ends) cable harness contains the combined 24-wires ending with 24 individually numbered ≈6 inch flying leads for wiring to appropriate outputs.

Table 3 defines the cable plug pins, the pin type, and the match to the numbered flying lead. For instance: Pin 1 of Connector A is described as **1:M1: 1**, where **1**(connector pin)**: M1** (the defined

output)**:**, and **1** (numbered flying lead). **Appendix E** Table 10 lists available cable harness options.

Table 3. HN-1026 and HN-1027 Cable Harnesses Pins to Flying Leads Assignments

Conn.	Pins to Leads Assignments (Pin: Type: Lead)					
A	1: M1: 1	2: M2: 2	3: M3: 3	4: M4: 4	5: M5: 5	6: M6: 6
	7: M7: 7	8: M8: 8	9: +VIN: 9	10: +VIN: 10	11: GND: 11	12: GND: 12
C	1: M9: 13	2: M10: 14	3: M11: 15	4: M12: 16	5: M13: 17	6: M14: 18
	7: M15: 19	8: M16: 20	9: +VIN: 21	10: +VIN: 22	11: GND: 23	12: GND: 24
D	1: M17 NC: 1	2: M17 COM: 2	3: M17 NO: 3	4: M18 NC: 4	5: M18 COM: 5	6: M18 NO: 6
	7: M19: 7	8: M20: 8	9: +VIN: 9	10: +VIN: 10	11: GND: 11	12: GND: 12
B	1: CANH: 13	2: CANL: 14	3: CANTERM: 15	4: RS232TX: 16	5: RS232RX: 17	6: M21: 18
	7: M22: 19	8: M23: 20	9: M24: 21	10: +VIN: 22	11: GND: 23	12: GND: 24
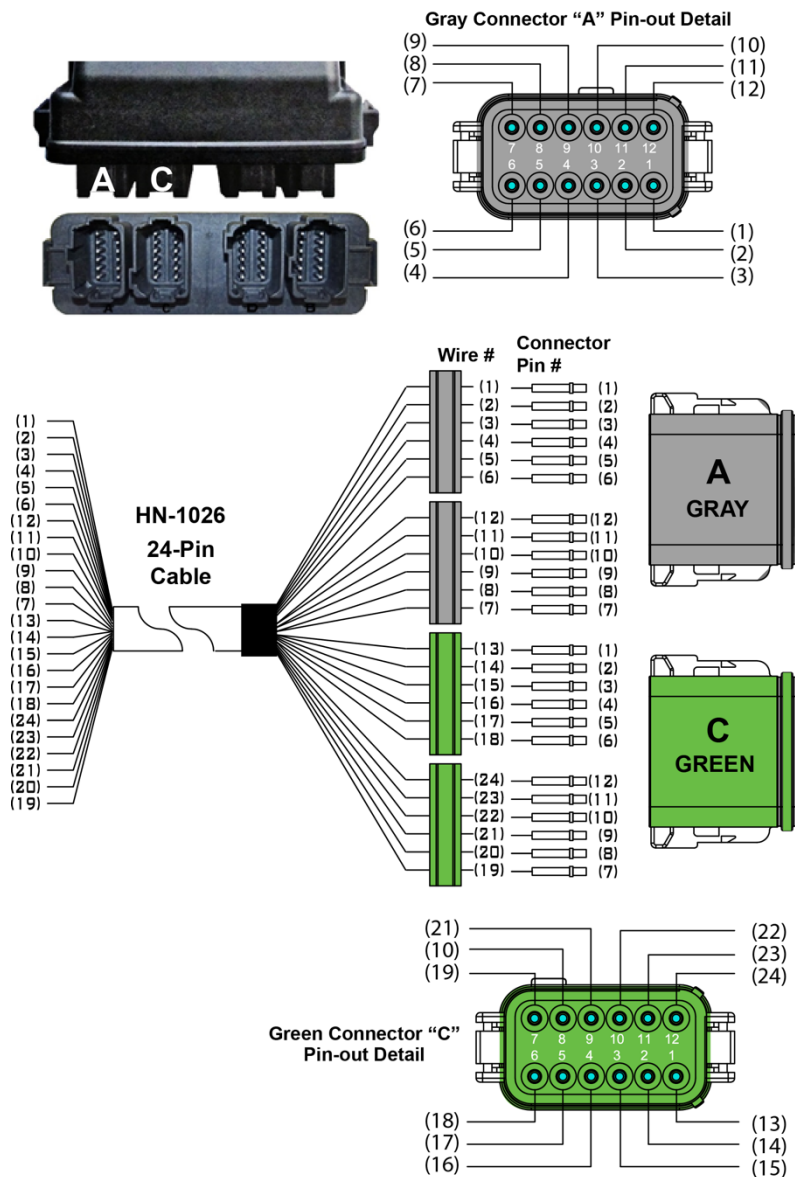
Figure 3. EBU-xH24XF Base Unit and Harness HN-1026 Pinouts
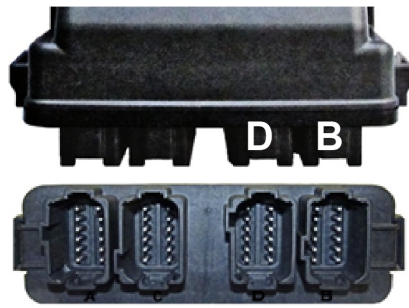
Brown Connector "D" Pin-out Detail

(9)
(8)
(7)

7 8 9 10 11 12
6 5 4 3 2 1

(10)
(11)
(12)

(6)
(5)
(4)

(1)
(2)
(3)

D B

Wire #

Connector Pin #

(1)
(2)
(3)
(4)
(5)
(6)

**HN-1027
24-Pin
Cable**

(1)
(2)
(3)
(4)
(5)
(6)
(12)
(11)
(10)
(9)
(8)
(7)
(13)
(14)
(15)
(16)
(17)
(18)
(24)
(23)
(22)
(21)
(20)
(19)

(1)
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(3)
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(6)

(12)
(11)
(10)
(9)
(8)
(7)

(12)
(11)
(10)
(9)
(8)
(7)

**D
BROWN**

(13)
(14)
(15)
(16)
(17)
(18)

(1)
(2)
(3)
(4)
(5)
(6)

(24)
(23)
(22)
(21)
(20)
(19)

(12)
(11)
(10)
(9)
(8)
(7)

**B
BLACK**

(21)
(10)
(19)

(22)
(23)
(24)

7 8 9 10 11 12
6 5 4 3 2 1

**Black Connector "B"
Pin-out Detail**

(18)
(17)
(16)

(13)
(14)
(15)

Figure 4. EBU-xH24XF Base Unit and Harness HN-1027 Pinouts

5.2 Individual Wiring Harness Models HN-1016 to HN-1019

Individual wiring harness models HN-1016, HN-1017, HN-1018, and HN-1019 are illustrated and defined in the following four tables and figures. Each have pins (1–12) that directly relate to the individually numbered leads (1–12) of the each cable, though the output assignments of each cable are unique to the specific cable as shown in the following four tables.

Wiring Harness HN-1016

Table 4. EBU-xH24XF Base Unit Harness HN-1016 (Socket A)

Socket	Pins 1 through 12 Assignments					
A	1: M1	2: M2	3: M3	4: M4	5: M5	6: M6
	7: M7	8: M8	9: +VIN	10: +VIN	11: GND	12: GND

Figure 5. EBU-xH24XF Base Unit Harness HN-1016 (Socket A)

Wiring Harness HN-1017

Table 5. EBU-xH24XF Base Unit Harness HN-1017 (Socket C)

Socket	Pins 1 through 12 Assignments					
C	1: M9	2: M10	3: M11	4: M12	5: M13	6: M14
	7: M15	8: M16	9: +VIN	10: +VIN	11: GND	12: GND
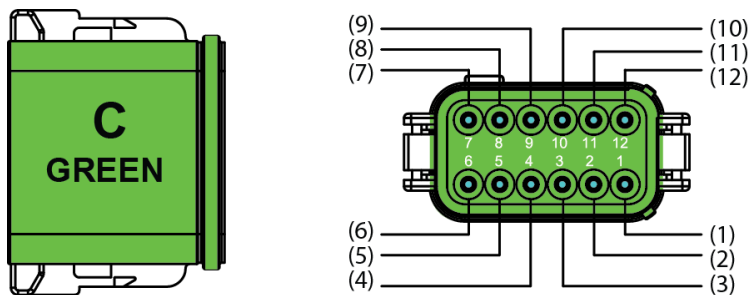
Figure 6. EBU-xH24XF Base Unit Harness HN-1017 (Socket C)

Wiring Harness HN-1018

Table 6. EBU-xH24XF Base Unit Harness HN-1018 (Socket B)

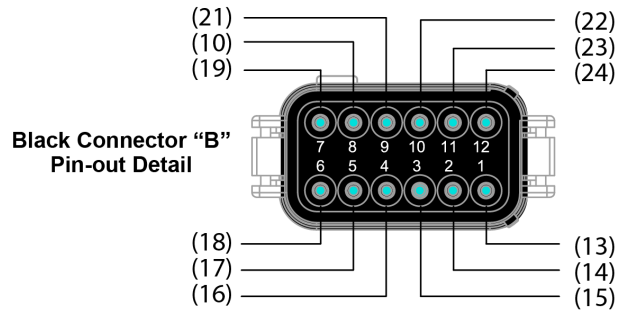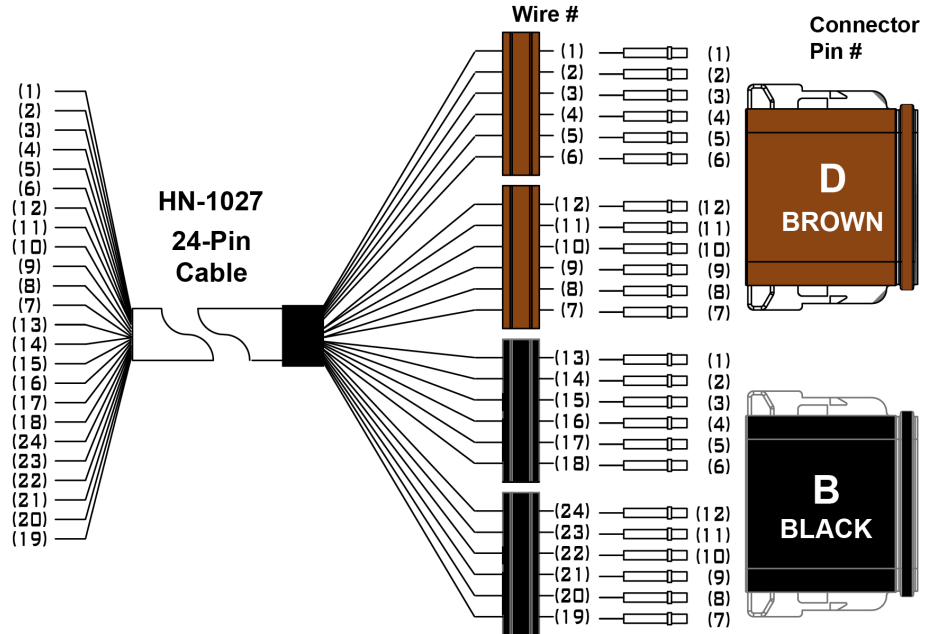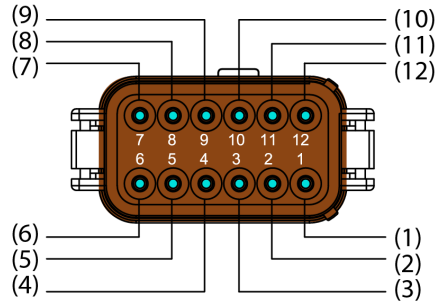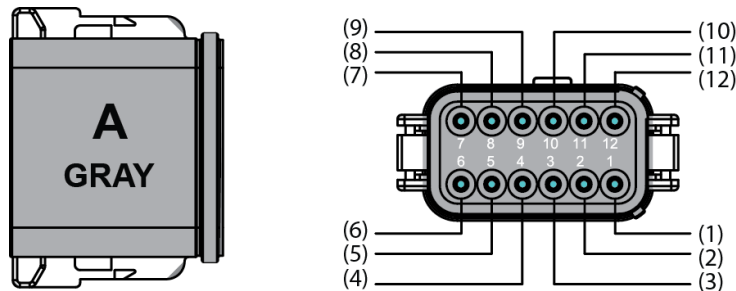| Socket	Pins 1 through 12 Assignments					
B	1: CANH	2: CANL	3: CANTERM	4: RS232TX	5: RS232RX	6: M21
	7: M22	8: M23	9: M24	10: +VIN	11: GND	12: GND
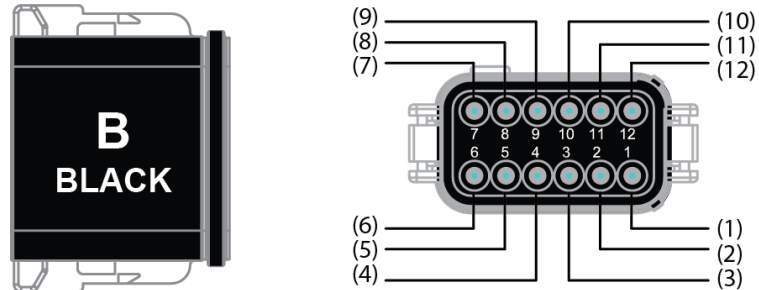
Figure 7. EBU-xH24XF Base Unit Harness HN-1018 (Socket B)

Wiring Harness HN-1019

Table 7. EBU-xH24XF Base Unit Harness HN-1019 (Socket D)

Socket	Pins 1 through 12 Assignments					
D	1: M17 NC	2: M17 COM	3: M17 NO	4: M18 NC	5: M18 COM	6: M18 NO
	7: M19	8: M20	9: +VIN	10: +VIN	11: GND	12: GND
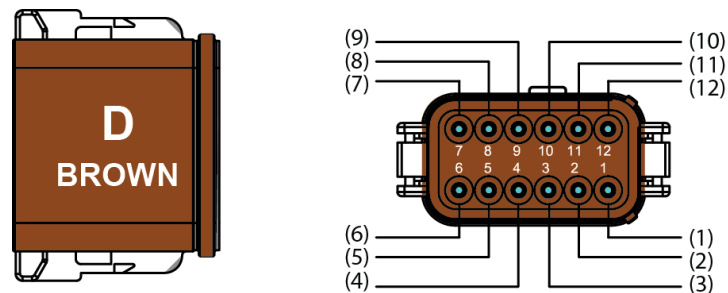
Figure 8. EBU-xH24XF Base Unit Harness HN-1019 (Socket D)

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6.0 SmaRT Handheld & Base Unit Remote Association

A SmaRT remote control system must have communications between the SmaRT handheld control unit and the EBU-xH24XF base unit is set up at the factory using an Associate process prior to shipping the system. The Associate process can be performed in the field when necessary—troubleshooting or replacing a SmaRT component for instance—using the Associate method prescribed in the particular SmaRT handheld remote manual that was originally sent with the system. Please refer to the handheld remote manual or Engineering System manual that was sent with the system for Associate process details.

SmaRT MCB

SmaRT Console Box

SmaRT HH-xH06

SmaRT HH-xH10

SmaRT Pistol Grip

Figure 9. SmaRT EBU-xH24XF Associate Illustration with Various SmaRT Handhelds

7.0 SmaRT EBU-xH24XF Specifications

Table 8. EBU-xH24XF Base Unit Specifications

Item	Description			
Power	**Vin**	+7 to +28VDC		
Radio	**Frequency**	906–924MHz @ 10mW; 2405-2480MHz @ 100mW		
	License	Free		
	Modulation	DSSS		
	Antenna	External or Internal		
Environment	**Operating Temp**	-20°C to 55°C (-4°F to 131°F)		
	Storage Temp	-40°C to 85°C (-40°F to 185°F)		
	Humidity	0 to 100%		
Indicators (5)	**1 – Power**	OK when amber		
	2 – OUT/IN	Green – output(s) only active; Red-input(s) only active Amber – output(s) and input(s) active		
	3 – HEALTH	Blinking when active		
	4 – RF TX/RX	Red – TX only active; Green-RX only active; Amber TX/RX active		
	5 – CAN TX/RX	Red – TX only active; Green-RX only active; Amber TX/RX active		
Enclosure	**Dimensions**	6.25" x 8.06" x 2.09" (119mm x 133mm x 36mm)		
	Durability	High Impact Polymer		
	Mounting Holes	7.4mm (0.29") dia. 5.63" center-to-center (143mm center-to-center)		
	Weight	1.45lbs (0.66kg)		
Outputs/Inputs	**H-Bridge**	One @ 4A (M1, M2)		
	Active Low (<1V)	Sixteen (M1−M16) digital inputs		
	FET	Eight Open Drain @ 2A per channel with current sense (M1−M8) Eight Open Drain @ 4A per channel (M9−M16)		
	Form C Relay	Two @ 8A per channel (M17, M18)		
	Analog Inputs	Four 0-10V (M21−M24)		
	Analog Outputs	Two 0-10V (M19−M20)		
CAN	**Open**	Plug B (Black) P1: CANH; P2: CANL; P3: CANTERM		
Terminals	**Plug A (Gray)** **Pins 1-12**	1: M1	2: M2	3: M3	4: M4
		5: M5	6: M6	7: M7	8: M8
		9: +VIN	10: +VIN	11: GND	12: GND
	Plug C (Green) **Pins 1-12**	1: M9	2: M10	3: M11	4: M12
		5: M13	6: M14	7: M15	8: M16
		9: +VIN	10: +VIN	11: GND	12: GND
	Plug D (Brown) **Pins 1-12**	1: M17NC	2: M17COM	3: M17NO	4: M18NC
		5: M18COM	6: M18NO	7: M19	8: M20
		9: +VDC	10: +VDC	11: GND	12: GND
	Plug B (Black) **Pins 1-12**	1: CANH	2: CANL	3: CANTERM	4: RS23TX
		5: RS232RX	6: M21	7: M22	8: M23
		9: M24	10: +VIN	11: GND	12: GND

✔ *Note: EBU-xH24XF-CAN units are internally terminated at 1.2kΩ. Termination can be removed at the factory.*

Appendix A: Exposure to Radio Frequency Energy

SmaRT handheld remote units contain radio transceivers. When active, a handheld remote sends out radio frequency (RF) energy through its internal antenna. The SmaRT handheld remote complies with limits set by the FCC for operating distance from human tissue.

Appendix B: Agency Identification Label Locations

Figure 10. Agency Identification Label Locations

Appendix C: Antennas, Extensions, and Kits

Table 9 defines antennas, antenna extensions, and antenna kits available for the EBU-xH24XF-EXT base units.

Table 9. Compatible EBU-xH-24XF-7773 External Antenna Details

Part	Cervis Ref. No.
900MHz IS BAND Swivel Antenna	BB3-06
2.4GHz IS Band Swivel Antenna	BB3-07
3 ft. antenna extension cable	J5-07
10 ft. antenna extension cable	J5-02
10 ft. antenna cable (J5-02) and external antenna (BB3-06)	EXT-10-900
10 ft. antenna cable (J5-02) and external antenna (BB3-07)	EXT-10-200
3 ft. antenna cable (J5-07) and external antenna (BB3-06)	EXT-3-900
3 ft. antenna cable (J5-07) and external antenna (BB3-07)	EXT-3-200

✔*Note: Only the antenna recommended by Cervis, Inc. is to be used with the SmaRT base unit.*

Appendix D: EBU-xH24XF Model Specifications

Model	Freq.	RF Pwr	#Ch	Channel Types	Antenna	Input V
EBU-9H24XF-INT-AV4-AO2	900MHz	10mW	24	H-Bridge, FET, Digital In, Form C Relay	Internal	$7-28$VDC
EBU-9H24XF-EXT-AV4-AO2	900MHz	10mW	24	H-Bridge, FET, Digital In, Form C Relay	External	$7-28$VDC
EBU-2H24XF-INT-AV4-AO2	2.4GHz	100mW	24	H-Bridge, FET, Digital In, Form C Relay	Internal	$7-28$VDC
EBU-2H24XF-EXT-AV4-AO2	2.4GHz	100mW	24	H-Bridge, FET, Digital In, Form C Relay	External	$7-28$VDC

✓*Note: EBU-xH24XF-CAN units are internally terminated at 1.2kΩ. Termination can be removed at the factory.*

Appendix E: EBU-xH24XF Cable Harness Options

Table 10. EBU-xH24XF Cable Harnesses

Part #	Connector Colors	Cable
HN-1026	GRAY and GREEN	Two 12-pin connectors; 24 wire; ≈90 inch total length. Individually numbered ≈6 inch flying leads
HN-1027	BROWN and BLACK	Two 12-pin connectors; 24 wire; ≈90 inch total length; Individually numbered ≈6 inch flying leads
HN-1016	GRAY	One 12-pin connector; 12 wire; ≈90 inch total length. Individually numbered ≈6 inch flying leads
HN-1017	GREEN	One 12-pin connector; 12 wire; ≈90 inch total length. Individually numbered ≈6 inch flying leads
HN-1018	BLACK	One 12-pin connector; 12 wire; ≈90 inch total length. Individually numbered ≈6 inch flying leads
HN-1019	BROWN	One 12-pin connector; 12 wire; ≈90 inch total length. Individually numbered ≈6 inch flying leads