



BU-xH16AF
BU-9H16AF and BU-2H16AF
Base Units Manual
U064.5.0

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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:

- (1) This device may not cause harmful interference and
- (2) 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 Canadian 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.

L'installateur de cet équipement radio doit s'assurer que l'antenne est située ou orientée de façon à ne pas émettre un champ RF dépassant les limites de Santé Canada pour la population générale; consulter le Code de sécurité 6, disponible sur le site Web de Santé Canada <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.

IC 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 (e.i.r.p.) is not more than that necessary for successful communication.

Partie 1 : 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-305) 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.

Partie 2 : Cet émetteur radio (LOBSRF-305) a été approuvé par Industrie Canada pour fonctionner avec le type d'antenne indiqué ci-dessous avec le gain maximal admissible et l'impédance d'antenne requise pour chaque type d'antenne indiqué. Il est strictement interdit d'utiliser avec cet appareil un type d'antenne ne figurant pas dans cette liste ou ayant un gain supérieur au gain maximum indiqué pour ce type.

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:

CERVIS, Inc.

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

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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.*
- ✓ *Equipment owner/operators must abide by all applicable Federal, State, and Local laws concerning equipment installation and operation. 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.*
- ✓ *Remove power from the base unit by detaching the 12-pin cables from the base unit connectors P1 and P2 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 cause destruction of or damage to the base unit.*
- ✓ *Operate and store units only within the specified operation and storage temperatures defined in this document's specifications.*
- ✓ *Keep high-energy radio frequency (RF) devices away from handheld remotes. Activating high-power communication radios, for instance, in close proximity to handheld remotes can cause interference and "false" circuit activation.*
- ✓ *Do not key two-way radios while using the handheld remote.*

1.0 BU-xH16AF Base Unit

Note: The x in BU-xH16AF represents the base unit operating frequency. It is either operating at 900 MHz — where the frequency is 906–924 MHz — or at 2.4 GHz, where the frequency is 2405–2480 MHz.



Figure 1. SmaRT BU-xH16AF-INT Base Unit

The versatile BU-9H16AF and BU-2H16AF base units feature eight FET (field effect transistor) high-side switching outputs or switch-to-ground digital inputs, eight 0–10 VDC or 4–20 mA analog outputs, and control area network (CAN) Bus control capability. Cervis, Inc. can customize the versatile, programmable digital and analog outputs/inputs to fit specific user applications.

The BU-9H16AF and BU-2H16AF accept a broad range of input power with operating voltages ranging from +7 VDC to +28 VDC. The rugged weatherproof enclosure allows units to operate worry free in harsh weather conditions. Two 12-wire color-keyed weatherproof connecting cables connect the controlled devices.

Using Channel-Hopping Direct Sequence Spread Spectrum (DSSS) wireless technology at 900 MHz or 2.4 GHz, the base unit provides a robust link with a SmaRT handheld remote control unit in congested radio environments. SmaRT base units feature seamless association to SmaRT handheld remotes without the need to open either the handheld remote or base unit case.

Features

- ☞ DSSS Technology (900 MHz @ 10 mW, 2.4 GHz @ 100 mW)
- ☞ Eight Analog Inputs/Outputs (0–10 VDC or 4–20 mA)
- ☞ Eight FET Outputs/Inputs
- ☞ Dual Connectors for Ease of Wiring
- ☞ Translucent Case
- ☞ Weatherproof
- ☞ Diagnostic Output LEDs
- ☞ CAN Bus Capable
- ☞ Compact Design

2.0 SmARt BU-xH16AF in SmARt Remote Control Systems

The basic standard SmARt Remote Control System consists of at least one SmARt base unit, a SmARt remote control unit, and the wiring harness that connects the base unit to the controlled apparatus. A single base unit can communicate with multiple SmARt remotes. A variety of compatible remotes is available, including: PTO-xH06, PTO-xH04, and PTO-xH02; PG-xH14, and other pistol-grip remotes; OO-218 and DO-218 18-button handheld remotes; and a wide assortment of other SmARt Console Remotes. For a full list of compatible SmARt remote controllers, contact your Cervis, Inc. Sales representative.

Communications between the BU-xH16AF base unit and the remotes are established at the factory using an association process. This process can also be easily performed on site when necessary using the SmARt remote without opening either device's enclosure. Association processes for each remote control unit are described in detail in each SmARt remote manual, Cervis, Inc. Engineering SpecSheets, and the documentation provided to you with your system.



Figure 2. SmARt BU-xH16AF with SmARt Remote Control Units

2.1 BU-xH16AF Base Unit Installation

CAUTION



Make sure the machine which the base unit will be installed on is disabled during installation.

Base Units subjected to the elements must be vertically installed. Cervis, Inc. recommends installing all base unit top-side UP (vertical).

Use the configuration diagrams supplied by Cervis, Inc. as a guide when mounting the base unit and connecting the wiring harnesses. Figure 3 and Figure 4 illustrate the dimensions for drilling mounting holes. Figure 6 illustrates the field wiring connections.

2.1.1 Smart BU-xH16AF-INT

Make sure that the unit is mounted so that there is a clear, unobstructed line of sight to minimize the chance of communications problems. See Figure 3 for mounting dimensions.

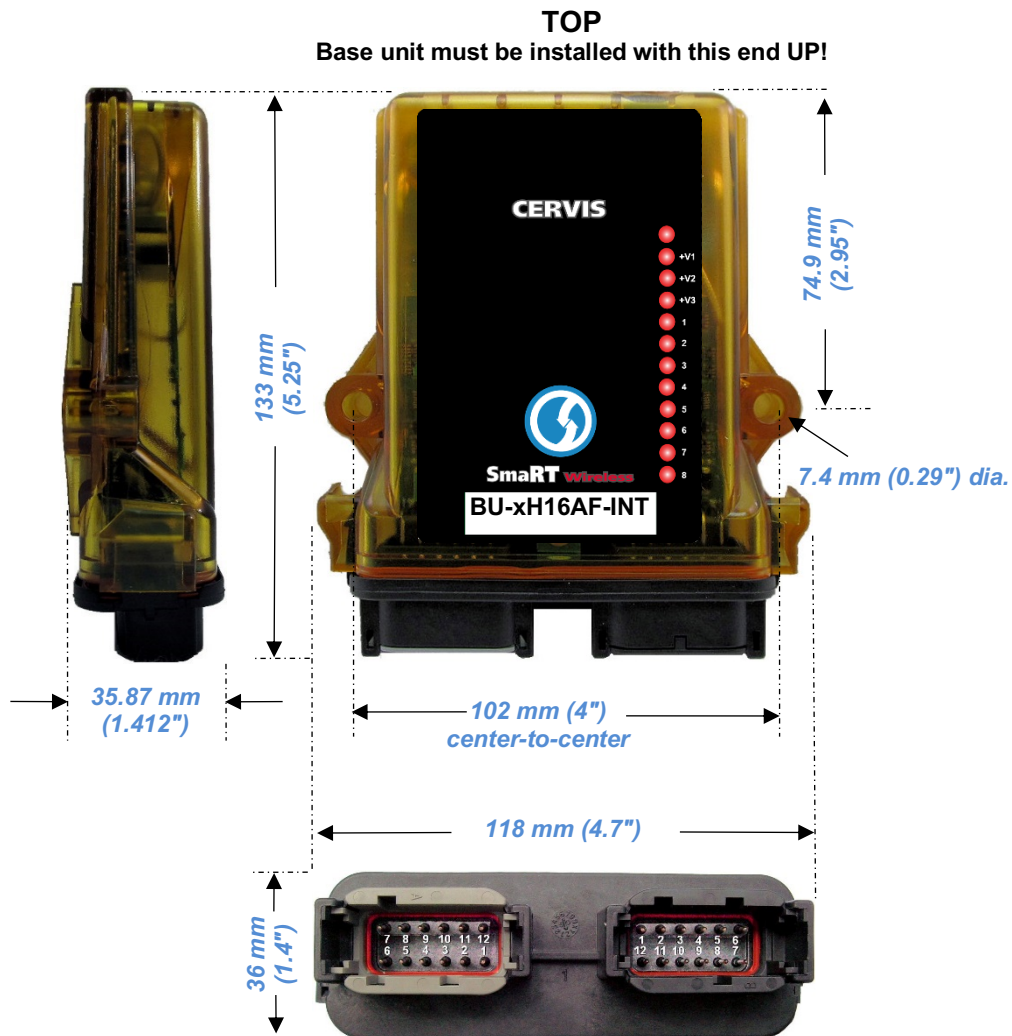


Figure 3. Smart BU-xH16AF-INT Mounting Dimensions

2.1.3 Optional Antenna Extension Kit Installation

Make sure the antenna is located in clear line-of-sight of the remote.

1. Loosen and remove extension cable nut to allow the antenna ferrule to push through a mounting hole (user discretion).
2. Rethread the nut to secure the ferrule to the device.
3. Attach cable extension to the BU-xH16AF-EXT.
4. Attach the antenna to the extension ferrule.

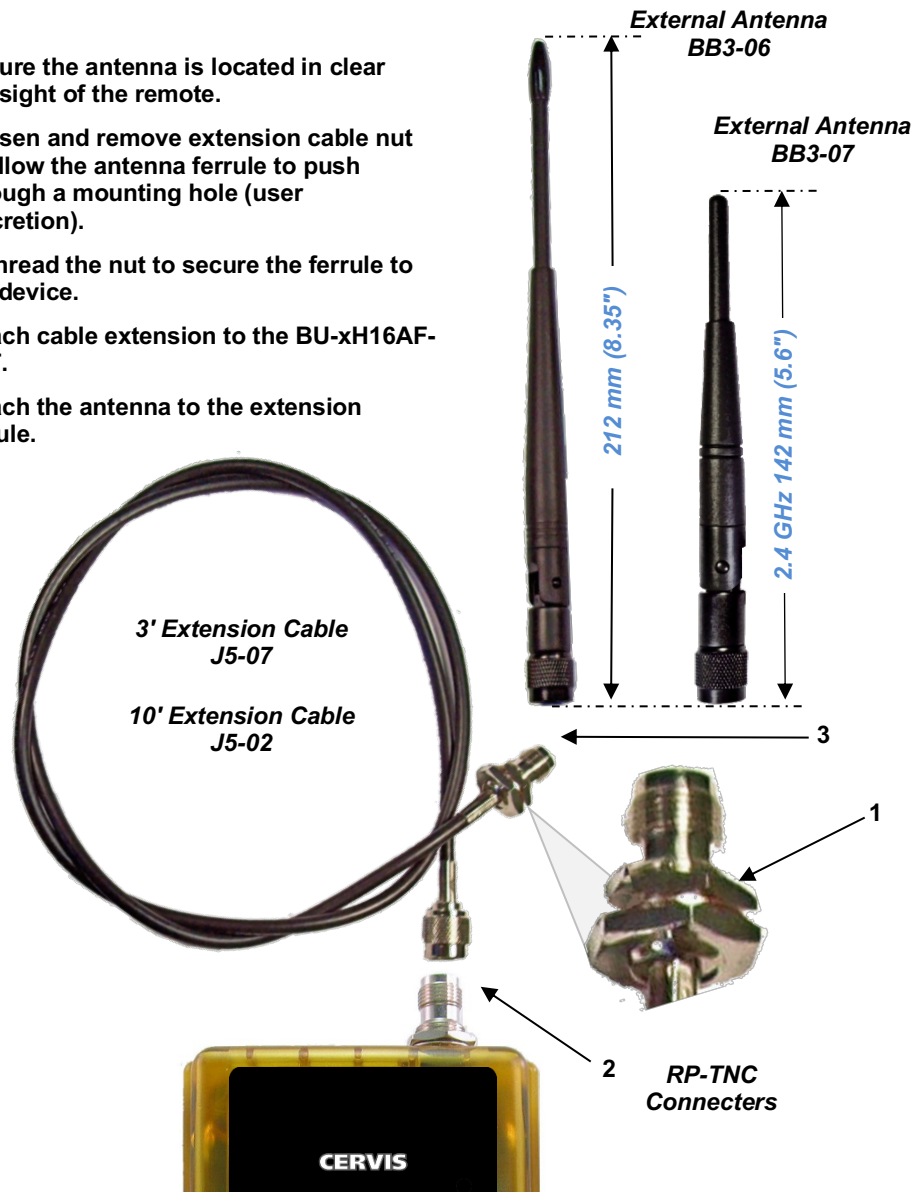


Figure 5. Antenna Extension Kit Installation

2.1.4 SmARt BU-xH16AF Wiring

Use the configuration diagrams supplied by Cervis, Inc. as a guide when connecting the wiring harness P1 and P2 connections. Table 1 is a simplified wiring guide for two typical types of Cervis, Inc. wiring harnesses. P1 Grey connector BB6-01 (HN-1001) and P2 black connector BB7-03 (HN-1002), each 12-wire cables, are numbered—marked from 1 to 11—with the last wire Yellow/Green. BB7-04 (HN-1005) uses 24 bundled, uniquely colored wires that relate and separate to the Grey P1 and Black P2 connectors. See Table 2 for particular harness options.

Figure 6 is a simplified field wiring chart that indicates generic P1 and P2 wiring.

Table 1. BU-xH16AF P1 and P2 Cable Wiring

Pin	BB6-01	Signal Name	Pin	BB7-03	Signal Name
	BB7-04			BB7-04	
P1:1	1	VDC+ (VBAT+)	P2:1	1	VDC+ (VBAT+)
	Red			Red-Blk	
P1:2	2	VDC+ (VBAT+)	P2:2	2	DIO 4
	Org			Org-Blk	
P1:3	3	DIO 6	P2:3	3	DIO 2
	Wht			Wht-Blk	
P1:4	4	DIO 8	P2:4	4	AIO 5
	Grn			Grn-Blk	
P1:5	5	AIO 4	P2:5	5	AIO 7
	Blu			Blue-Blk	
P1:6	6	AIO 2	P2:6	6	CANH/232 IN (RX)
	Red-Wht			Wht-Red	
P1:7	7	AIO 1	P2:7	7	CANL/232 OUT (TX)
	Grn-Wht			Red-Wht-Blk	
P1:8	8	AIO 3	P2:8	8	AIO 8
	Blue-Wht			Blk-Wht-Red	
P1:9	9	DIO 7	P2:9	9	AIO 6
	Blk-Wht			Wht-Blk-Red	
P1:10	10	DIO 5	P2:10	10	DIO 1
	Red-Grn			Blue-Red	
P1:11	11	VCC- (VBAT-)	P2:11	11	DIO 3
	Org-Grn			Org-Red	
P1:12	Ylw-Grn	VCC- (VBAT-)	P2:12	Ylw/Grn	VCC- (VBAT-)
	Black			Blk-Red	

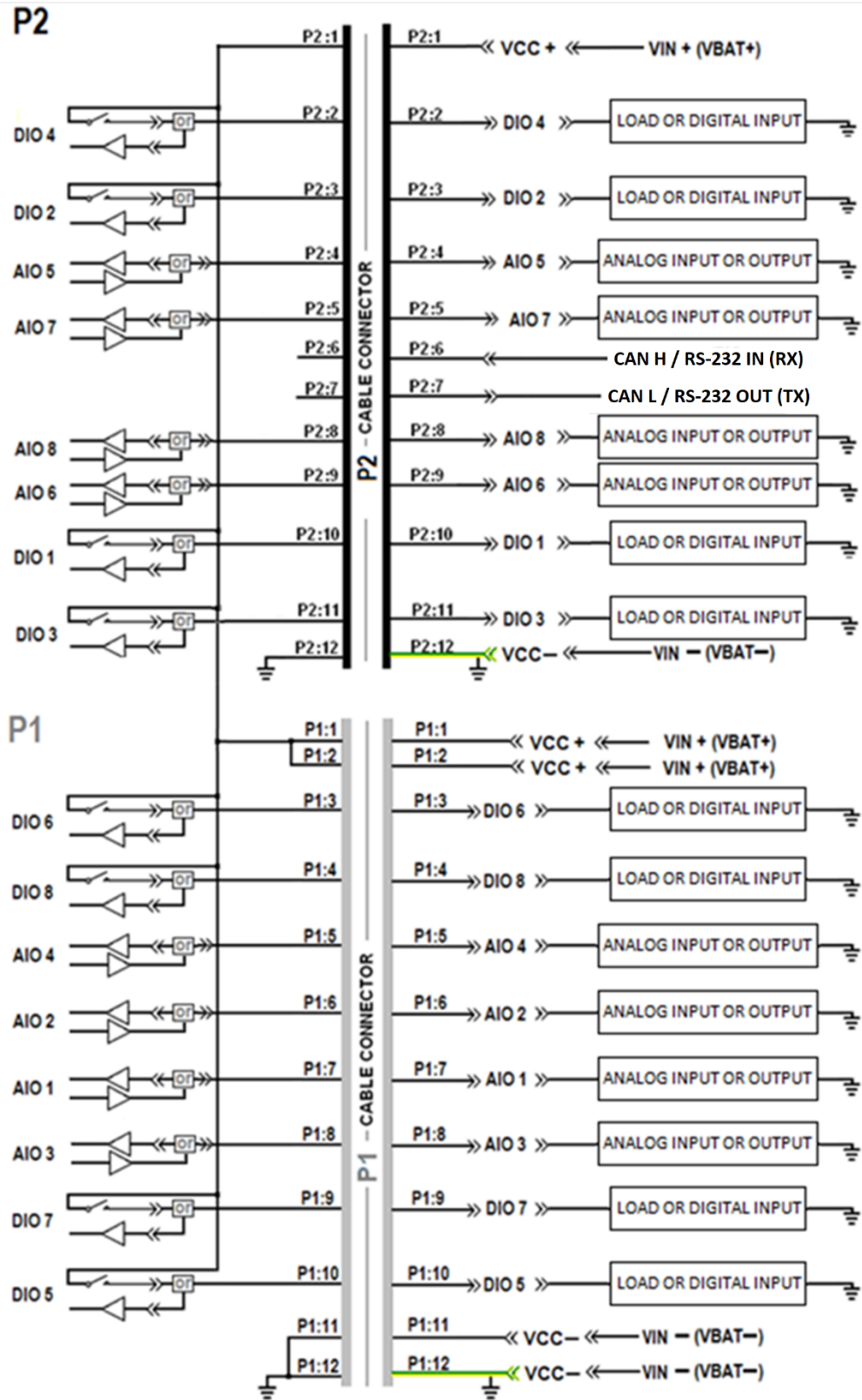


Figure 6. BU-xH16AF P1 and P2 Field Wiring

3.0 Associate Mode

Communications between the SmaRT BU-xH16AF and SmaRT remotes is established for systems before shipped from Cervis, Inc. There may be occasions when the communication link between remote and base unit will have to be established in the field. Access to the exact button or switch sequencing for the remote used while in Associate mode varies depending on the type of SmaRT remote that the base unit communicates with. Refer to the appropriate SmaRT remote control manual, Cervis, Inc. Engineering SpecSheet, or individual instructions provided by Cervis, Inc. with your system for the proper Associate Mode details.

CAUTION



Prevent inadvertent machine movement while establishing the communication link between SmaRT base units and remote controls. *Always remove power from base units by disconnecting P1 and P2 before attempting to Associate the remote to the base unit.*

4.0 Available Options

Following are some options available for the BU-xH16AF-INT and BU-xH16AF-EXT base units. For custom configuration of your particular base unit and system, consult with your Cervis, Inc. sales representative.

4.1 Cable Harness and Antenna Extension Kits

Table 2. Available Options

Part Number	Description
BB6-01	HN-1001 (gray) 12-conductor cable harness, 36 inches long
BB7-03	HN-1002 (black) 12-conductor cable harness, 36 inches long
BB7-04	HN-1005 24-conductor cable harness, 9 ft. length, black and grey connectors
BB3-06	900 MHz external antenna
J5-07	3-ft. antenna extension cable
J5-02	10-ft. antenna extension cable
EXT-10-900	10-ft. antenna cable (J5-02) and external antenna (BB3-06)
EXT-3-900	3-ft. antenna cable (J5-07) and external antenna (BB3-06)

4.2 Available Smart BU-xH16AF Variations

Table 3. Smart BU-xH16AF Variations

Name	Freq.	RF Power	Input Power	Serial Port	Digital Channels	Analog Channels	Antenna
BU-2H16AF-INT-8F-8V-CN	2.4 GHz	100 mW	7-28 VDC	CAN	8 FET	(8) 0-10 V OUT	Internal
BU-2H16AF-EXT-8F-8V-CN	2.4 GHz	100 mW	7-28 VDC	CAN	8 FET	(8) 0-10 V OUT	External
BU-2H16AF-INT-8F-8A-CN	2.4 GHz	100 mW	7-28 VDC	CAN	8 FET	(8) 4-20 mA OUT	Internal
BU-2H16AF-EXT-8F-8A-CN	2.4 GHz	100 mW	7-28 VDC	CAN	8 FET	(8) 4-20 mA OUT	External
BU-9H16AF-INT-8F-8V-CN	900 MHz	10 mW	7-28 VDC	CAN	8 FET	(8) 0-10 V OUT	Internal
BU-9H16AF-EXT-8F-8V-CN	900 MHz	10 mW	7-28 VDC	CAN	8 FET	(8) 0-10 V OUT	External
BU-9H16AF-INT-8F-8A-CN	900 MHz	10 mW	7-28 VDC	CAN	8 FET	(8) 4-20 mA OUT	Internal
BU-9H16AF-EXT-8F-8A-CN	900 MHz	10 mW	7-28 VDC	CAN	8 FET	(8) 4-20 mA OUT	External

5.0 Specifications

Table 4. SmaRT BU-xH16AF Specifications

Item	Description	
Power	V _{in}	+7 to +28 VDC
Radio (disabled)	Frequency	906–924 MHz 2425–2480 MHz
	RF Power	10 mW (max.)
	License	License-Free
	Modulation	Channel-Hopping DSSS
	Antenna	Internal or External (option)
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 (12)	Unmarked	V _{in} polarity indicator; polarity reversed when lit solid
	+V1 – +V3	OK when active solid
	1	Health – OK when blinking 1x/sec
	2	RF TX – Flashes when transmitting
	3	RF RX – Flashes when receiving
	4	CAN TX – Flashes when transmitting
	5	CAN RX – Flashes when receiving
	6	Output – OK when blinking 1x/sec
	7	Input – OK when blinking 1x/sec
8	Error – Error occurring when lit solid	
Enclosure	Dimensions	mm: 133 x 118 x 36 inch: 5.25 x 4.7 x 1.4
	Durability	High Impact Polymer
	Mounting Holes	mm: 7.4 dia. 102 center-to-center Inch: 0.29 dia. 4.00 center-to-center
Outputs/Inputs	Digital	Eight FET—Open Drain
	Analog	Eight 0–10 VDC, 4–20 mA (FET only)
	Current	4 A per channel 15 A Max. @ 55° C
Umbilical (option)	CAN Bus	SAE J1939
	CAN Termination	3.3 k Ω (internal)


 **Note:** BU-xH16AF-CN units are internally terminated at 3.3 k Ω . Termination can be removed at the factory.

Table 5. SmaRT BU-xH16AF Pinout

P1 Pin	Assignment	P1 Pin	Assignment
P1:1	+VDC	P1:7	AIO 1
P1:2	+VDC	P1:8	AIO 3
P1:3	DIO 6	P1:9	DIO 7
P1:4	DIO 8	P1:10	DIO 5
P1:5	AIO 4	P1:11	-VDC
P1:6	AIO 2	P1:12	-VDC

P2 Pin	Assignment	P2 Pin	Assignment
P2:1	+VDC	P2:7	CANL
P2:2	DIO 4	P2:8	AIO 8
P2:3	DIO 2	P2:9	AIO 6
P2:4	AIO 5	P2:10	DIO 1
P2:5	AIO 7	P2:11	DIO 3
P2:6	CANH	P2:12	-VDC

Appendix A: Exposure to Radio Frequency Energy

SmaRT base units contain radio transceivers. When active, a SmaRT base unit sends out radio frequency (RF) energy through its internal antenna. The SmaRT base unit complies with limits set by the United States Federal Communications Commission (FCC) for operating distance from human tissue.

Appendix B: Agency Identification Label Locations



Note: Individual agency labels may differ, but SmaRT base unit models use the illustrated label positions for all agency labels. It is identical for both internal antenna and external antenna base units.

Figure 7. Agency Identification Label Locations

