Application Note

BRTSYS_AN_092

LDSBus System Overview

Version 1.0

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The LDSBus (Long-Distance Sensor Bus) from BRT Systems is a highly scalable and versatile interface allowing connection of large numbers of sensors and actuators over long distances. In this application note, we provide an overview of the LDSBus and its key components.

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1 Introduction

The LDSBus (Long-Distance Sensor Bus) from BRT Systems is a highly scalable and versatile interface allowing connection of large numbers of sensors and actuators over long distances. In this application note, we provide an overview of the LDSBus and its key components.

Smart systems continue to offer solutions to long-standing problems such as improving yields and reducing resource wastage in agriculture and aquaculture and improving occupant comfort whilst reducing running costs and environmental footprint in smart buildings. Sensors and actuators play a vital role in these systems, monitoring the environment around them and responding in a timely manner without constant human intervention. One big challenge, however, is how to connect these sensors and actuators. At a system level, it is often the case that individual sensor instruments do their job well, but do not integrate well as an overall system with other devices being used alongside them. Difficulties are often encountered where the system covers a large area. Challenges in connecting large arrays of sensors and actuators include:

- Different Protocols: Sensors and actuators from different manufacturers and for different application areas use different protocols and messaging formats
- Distance: Many common interface types are for short range connections only
- Configuration and Data Processing: Most sensor devices need to be configured (and may need calibration) to perform their function
- Power Supply Requirements: Different sensors and actuators have different power supply requirements, requiring separate cable runs or local power sockets
- Cabling and Connectors: Sensors often have different cable type requirements, as well as custom connector types
- Lack of Interoperability: The above factors can hinder the ability of the devices to work together as a unified system and thus reduce the benefits

The LDSBus (Long-Distance Sensor Bus) from BRT Systems (BRTSys) addresses these issues. LDSBus is a highly scalable and versatile interface allowing connection of large numbers of sensors and actuators over long distances. The overall system comprises of three main parts:

- Host Platform: A range of host platforms can be used which control the bus and communicate with the LDSUs over the bus to take readings and control devices
- Long Distance Sensor Units (LDSUs): A range of sensor and actuator devices which share a common standard LDSBus interface
- Long Distance Sensor Bus (LDSBus): A modular and flexible bus which allows LDSUs to be connected over long distances

Advantages include:

Long Distance and wide coverage - Each bus can extend for up to 200m in each direction from the gateway

Interoperability - All devices can co-exist on the same data bus and work together

Flexibility– LDSBus connections are daisy-chained using T-junctions. Each T-junction has four RJ11 ports for sensor/actuator modules

Bus-Powered – Sensors / Actuators are powered directly, no more battery power issues or local power outlets required

Reliable data transfer – Wired security and privacy, without concerns over signal fallout

Simple Installation - One CAT5e LDSBus cable with RJ45 connectors carries data *and* power with intuitive software to help with configuration

2 LDSBus

2.1 Connectivity

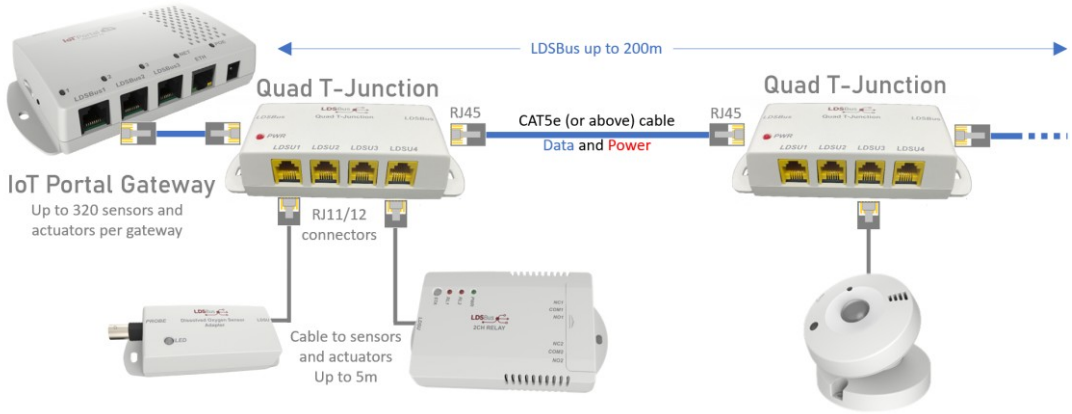


Figure 1 - LDSBus Overview

The LDSBus is a master-slave serial data communication bus that uses RS485 signalling. Unlike other serial busses, devices are bus-powered and operate at a fixed rate of 230Kbps. Slaves are called Long Distance Sensor Units (LDSU) and attach to the bus via T-Junctions known as Quad T-Junctions. These Quad T-Junctions allow up to 4 LDSUs to attach to the bus and the Quad T-Junctions are daisy chained together to form a bus as long as 200m.

The master is called the LDSBus Host and it attaches to the head end of the bus. LDSUs ship with a 5m cable to attach to the Quad T-Junction and the 200m distance is measured from the head-end to the furthermost LDSU, including the 5m patch cable.

The backbone of the bus is built using RJ-45 Cat5E (default) and operates at 24V, whereas the T-Junctions extend the bus to the LDSU with a 5m cable drop which is powered at 5V. Note that selecting CAT6 or CAT7 cable does not offer an operational benefit for LDSBus.

All communication on the bus is controlled and initiated by the LDSBus Host. The host controls power to the ports. Slave devices do not communicate on the bus until they have been addressed by the host. Slave devices consist of an EEPROM which contains details about the device. The host uses the EEPROM information to perform automatic identification and configuration for true plug and play.

The LDSBus Configuration Utility is used to select a unique 7-bit address between 1 to 126, inclusive. LDSBus devices ship with 126 as the default address. The same utility is used to set device termination to ON/OFF state and to, optionally, assign a friendly device name to identify multiple instances of the same LDSU. (see section 4).

2.2 LDSBus Quad T-Junctions

The LDSBus Quad T-Junctions perform an important role to connect and extend the LDSBus over long distances (up to 200m) and to provide attachment points for LDSBus sensors and controllers. There are 2 versions of the T-junctions and these are described next.

2.2.1 Quad T-Junction

The Quad T-Junction facilitates a simple daisy-chained architecture, allowing sensors and actuators to be easily connected to the LDSBus. This modular architecture also allows easy extension and reconfiguration of the system in future.

The Quad T-Junction has the following features:

1. RJ45 IN and THRU ports which carry LDSBus data and 24V power
2. Four RJ11/12 ports, each providing data and 5V power to one LDSU
3. A 24V LDSBus to 5V LDSU voltage regulator, to provide 5V power to sensors and actuators
4. A power LED to confirm the presence of the 24V LDSBus power
5. Mounting ears for simple wall mounting (DIN rail mounting via kit available separately)
6. Powered entirely via the LDSBus 24V supply (no power adapter needed)

Note: Quad T-Junction LDSBus connections are not direction-dependent. Either RJ45 port can be used as the IN and the THRU connection.

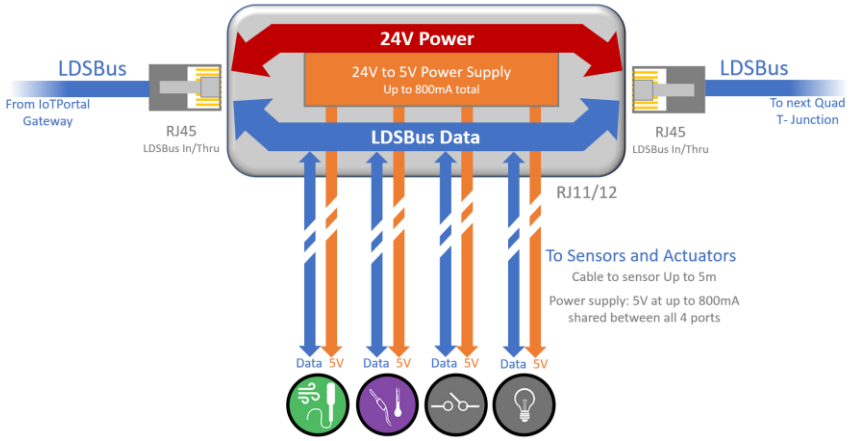


Figure 2 - Quad T-Junction Connections and Operation

2.2.2 Quad T-Junction 2

The Quad T-Junction 2 includes new Power sequencing and Overcurrent protection features.

The **power sequencing** feature enables power to each port in turn instead of turning all ports on at the same time. This avoids a current surge at power-up, allowing a larger number of LDSUs to be connected to an LDSBus compared to the first version of the Quad T-Junction.

When multiple Quad T-Junction 2's are daisy chained together on the LDSBus, the first Quad T-Junction 2 will switch power on to its four ports in turn, followed by the downstream LDSBus port. The second Quad T-Junction 2 will then be powered and will continue to enable it's 4 ports in turn. This sequence continues for any subsequent Quad T-Junction 2s.

Quad T-Junction and Quad T-Junction 2 devices can be mixed on an LDSBus. For details of the number of LDSUs which can be used in each case, refer to BRTSYS_AN_069-LDSBus_Quad-T-Junction-Usage and BRTSYS_TN_001 LDSBus Quad T-Junction Usage.

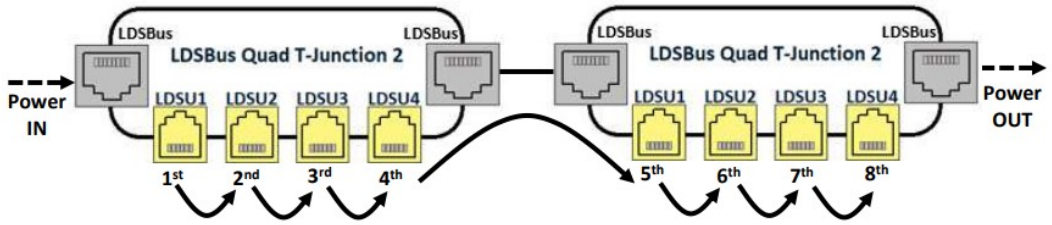


Figure 3 - Quad T-Junction 2 Power Sequencing

The **overcurrent protection** feature will turn off power to an LDSU port if a fault causes excessive current to be drawn. If a fault occurs on an LDSU port, this port and any higher-numbered ports on the same Quad T-Junction 2 will be switched off but other devices on the LDSBus will remain operational to minimise disruption. If the LDSBus Thru port detects overcurrent, all Quad T-Junction 2's downstream of that point will be turned off but LDSUs on the bus before the point of failure will remain powered. For more details, refer to BRTSYS_AN_069-LDSBus_Quad-T-Junction-Usage.

2.3 Extensive Systems

In this example, the three ports of the IoTPortal Gateway can be used, along with the long-distance capability, to cover a very wide area as large as 17 football fields. The built-in termination feature of the last LDSU on each LDSBus port is enabled (denoted by the blue status LED instead of the green color).

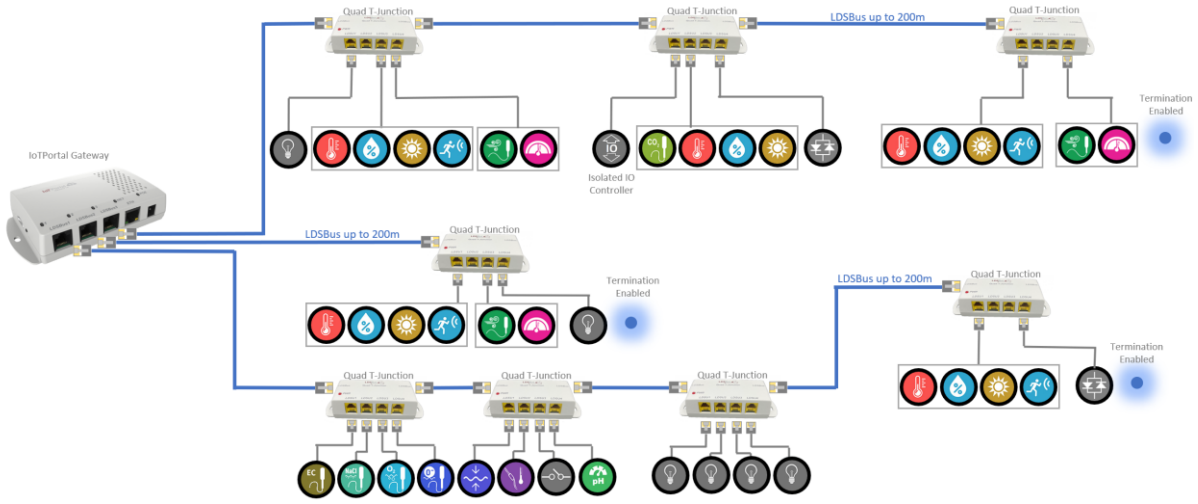


Figure 4 - Extensive LDSBus network using three ports on the IoTPortal Gateway

3 LDSBus Hosts

There are four types of LDSBus host are:

1. IoTPortal Gateway
2. Windows/Linux/RPi 3 and upwards
3. IDM2040 (RP2040)
4. PanL Hub80 and Hub44

The role of the LDSBus host includes the following actions:

- Scanning the bus to determine which LDSUs are present
- LDSU identification
- Loading of corresponding device drivers for the identified LDSUs
- Polling each LDSU to collect data from them and to send commands to actuators (each device can be polled at a different interval)
- Detecting and reporting unresponsive LDSUs or errors in LDSUs
- Configuring the mode of each LDSU controller
- Updating LDSU firmware

In this section, we will describe the key hardware and software components of each host.

3.1 IoTPortal Gateway

The Gateway hosts and manages three Long-Distance Sensor buses. For each bus, it performs the following functions:

1. Port power control and overcurrent control
2. Bus scan to discover and identify devices
3. Periodically poll sensors and actuators for sensor sample and actuator status information
4. Periodically poll devices which have become inactive/unresponsive
5. Queueing and sending commands to the actuators
6. Cache sensor data when offline and upload cached data when online connection is re-established

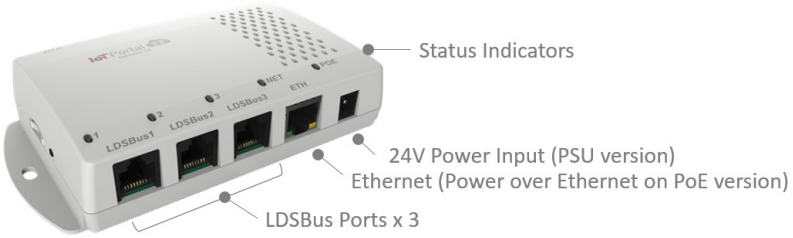


Figure 5 - IoTPortal Gateway

LDSBus Ports

There are 3 LDSBus ports on the gateway and each is powered at 24VDC. The amount of power that can be drawn from these ports depends on the type of gateway and its power source. The Gateway comes in 2 versions:

7. **Power Supply Unit (PSU) version –** The gateway is powered by a 65W 24VDC power adapter.
8. **Power Over Ethernet (PoE) version –** The gateway is powered by a Power Over Ethernet switch and supports IEEE802.3af and IEEE802.3at standards. from the on-premises network switch for example.

The PSU version of the gateway can provide up to 36W whereas the PoE version can provide up to 9.6W (IEEE802.3af) and 14.4W (IEEE802.3at) respectively. The PSU version can therefore power a larger number of LDSUs. Note that the PoE version does not have a power input jack and so cannot be used with an external PSU.

The following table shows the port power capabilities of the 2 types of gateways.

Power Source	Input Voltage	LDSBus Port Voltage	Max. Current (Per port)	Max. Current (3x ports)
IEEE802.3af	37.0V~57.0V	24.0V	400mA	400mA
IEEE802.3at	42.5V~57.0V	24.0V	400mA	600mA
Power Adaptor	24.0V / 65W	24.0V	500mA	1500mA

Table 1 - Power Supply

Each LDSBus port is protected with an overcurrent detector which immediately shuts down the port in case overcurrent is detected to protect the gateway and other devices on the bus. A gateway can host up to 80 LDSUs across its three ports and this maximum number depends on the power consumption of the devices. For details refer to LDSBus Quad T-Junction Usage Application Note and LDSBus_Quad-T-Junction-Usage_Technical_Note. LDSBus R J45 ports provide power and data to sensors/actuators. LED indicators on each port blink to show that communication is taking place, whilst the built in temperature sensor and over-current detection protect the gateway and LDSBus from error conditions.

Multiple gateways can be used and will all appear as part of a single unified system. For example, this allows greater areas distances to be covered or larger numbers of LDSUs than one gateway can support. The gateways may be located in different greenhouses which are spread apart across a large agricultural facility for example, or different buildings in an office complex, or in different parts of the world at a companies different offices.

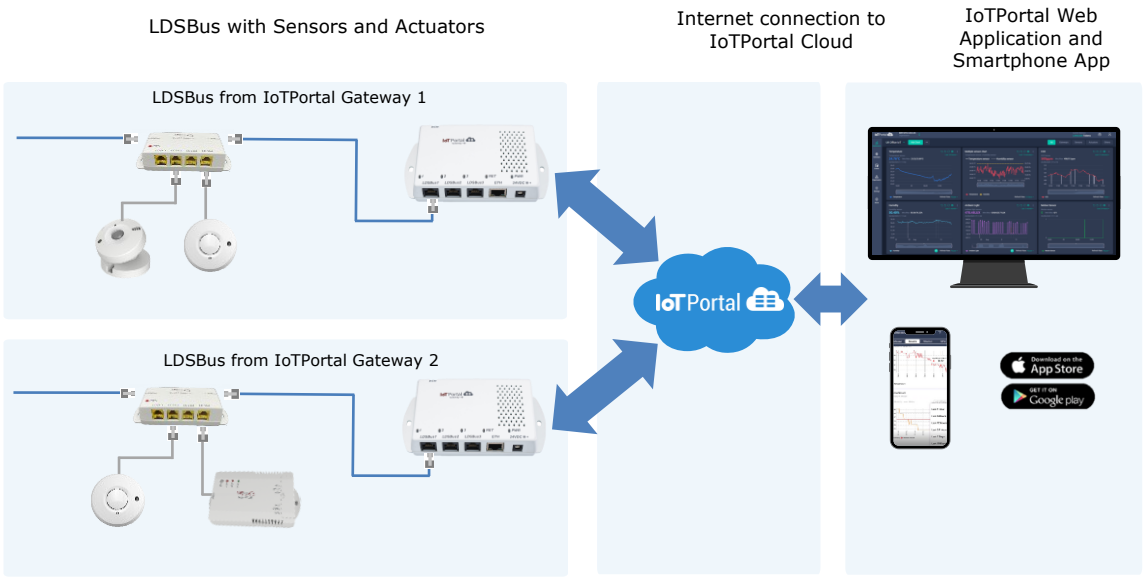


Figure 6 - Using multiple gateways located locally or remotely and connected via the IoTPortal Cloud service

3.2 USB Hosts - Windows/Linux/RPi3

The LDSBus can also be hosted using a computer system, with a USB Host port, running Windows, Linux or Raspberry Pi 3 or later. This solution is ideal for applications such as:

1. On-prem solutions (because of privacy or security concerns)
2. Connection to customer's private cloud or public cloud
3. Desktop applications

Key to using these systems as a LDSBus host is the LDSBus USB Adapter and the LDSBus Software Development Kit (SDK).

3.2.1 LDSBus USB Adapter

The LDSBus USB Adapter is used to connect LDSUs (Sensors and Actuators) to a computer over USB. The adapter performs two roles. The first is to form an LDSBus and the second is for LDSBus configuration (described in a later section). The video Unlocking BRTSys IoTPortal : How to Set Up the LDSBus USB Adapter with Ease has more information on the applications of the LDSBus USB Adapter.

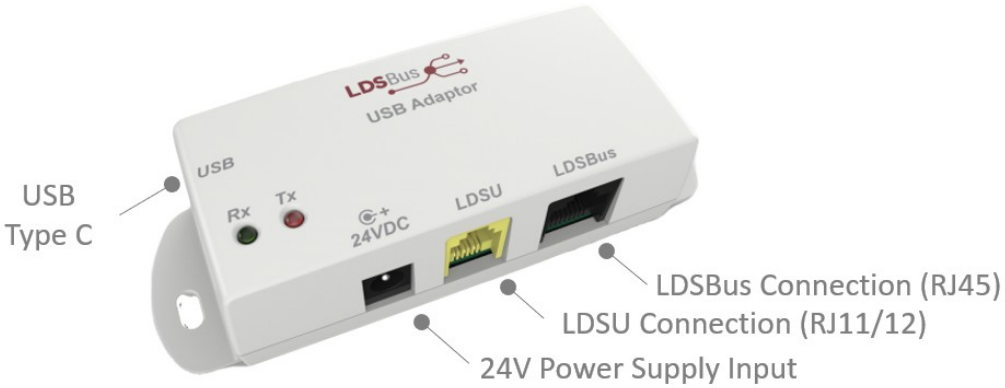


Figure 7 - LDSBus USB Adapter Connections and Features

The adapter connects to the USB port of the computer via a Type-C connector, and features Tx and Rx LEDs to indicate data communication activity. It ships with a 24V PSU. It has two ports where sensors and actuators can be attached.

3.2.2 LDSBus Formation

The RJ45 connector of the adapter acts as the LDSBus port supplying 24V power to the bus (sourced via the PSU) and data communications over the USB data interface from the host. The bus is constructed out of Cat5E or Cat6 RJ45 cables connected through Quad T-Junctions which provide attachment points for LDSBus sensors and controllers. The diagram shows the required connections.

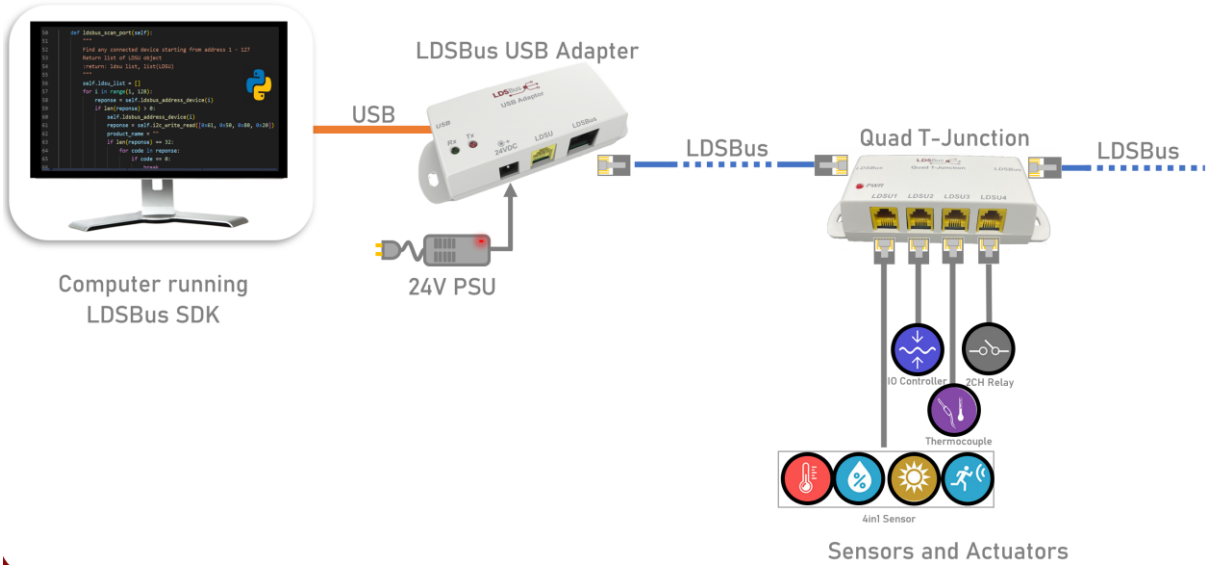


Figure 8 - LDSBus USB Adapter – LDSBus Port

3.2.3 LDSBus Host Software

The LDSBus host can be developed based on the LDSBus Python or LDSBus .NET Software Development Kits (SDKs) provided by BRT Systems. These include library functions to scan the bus for sensors and actuators, configure, control and read data from the sensors and actuators. They also include code examples which can be used as a starting point for application development. The SDKs can be downloaded from Software (SDK) - BRT Systems Pte Ltd.

The following platforms are supported:

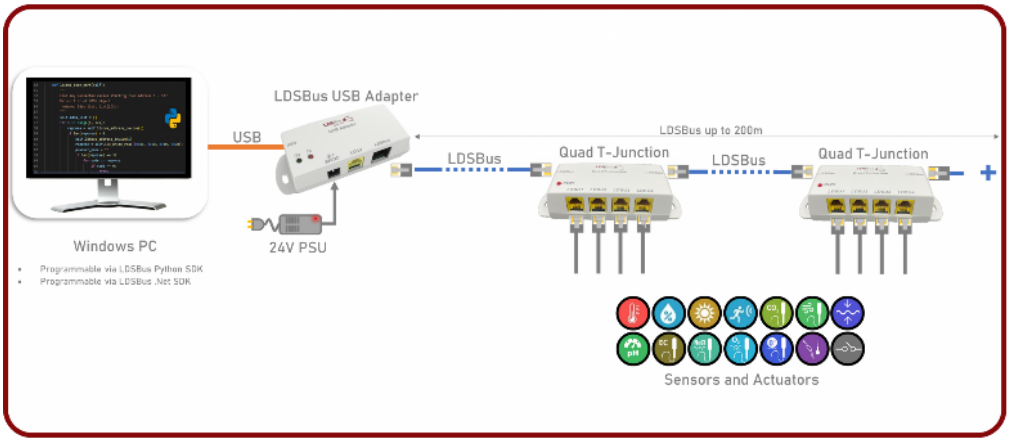


Figure 9 - Windows PC (Python and .NET SDKs)

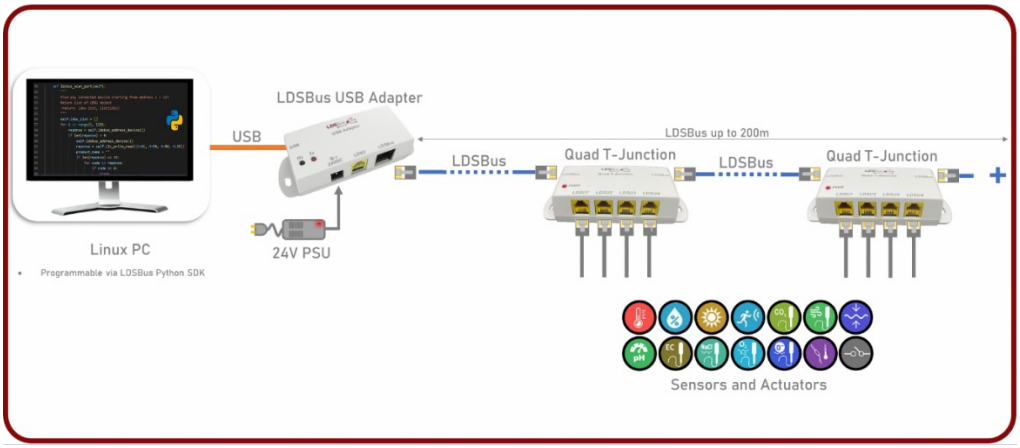


Figure 10 - Linux PC (Python SDK)

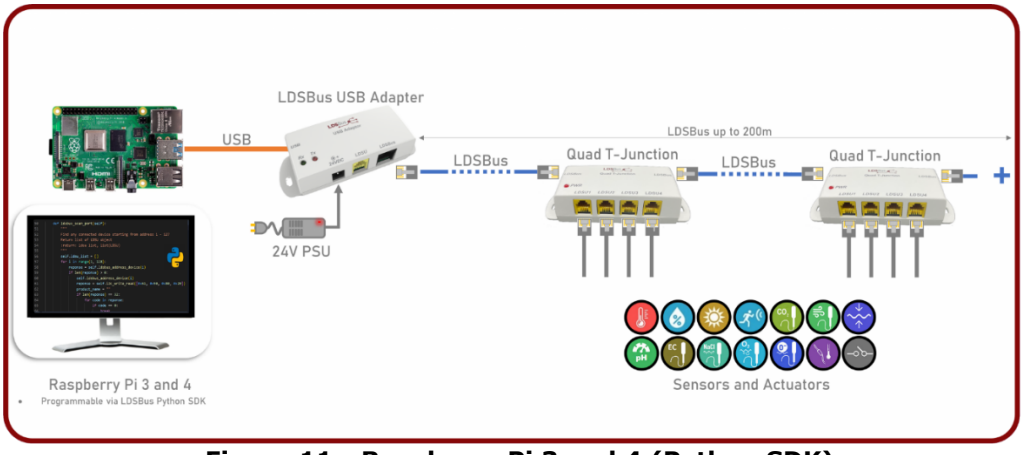


Figure 11 - Raspberry Pi 3 and 4 (Python SDK)

3.3 IDM2040-7A

The LDSBus Python SDK runs on bare-metal Raspberry Pi RP2040 embedded systems that support CircuitPython. One such system is the IDM2040 7" Intelligent Display module which comes built-in with an LDSBus host port and is ideal for local display of sensor parameters and actuator control. Applications include conference room monitoring and other applications such as industrial, agriculture and aquaculture where a dedicated panel is desired for monitoring and control of the system.

This solution does not use the web browser dashboard or mobile App, and application development is code-based. This can however provide additional flexibility to develop bespoke monitoring and control applications.

The IDM2040-7A has an on-board LDSBus RJ45 connector and so does not require an LDSBus USB Adapter.

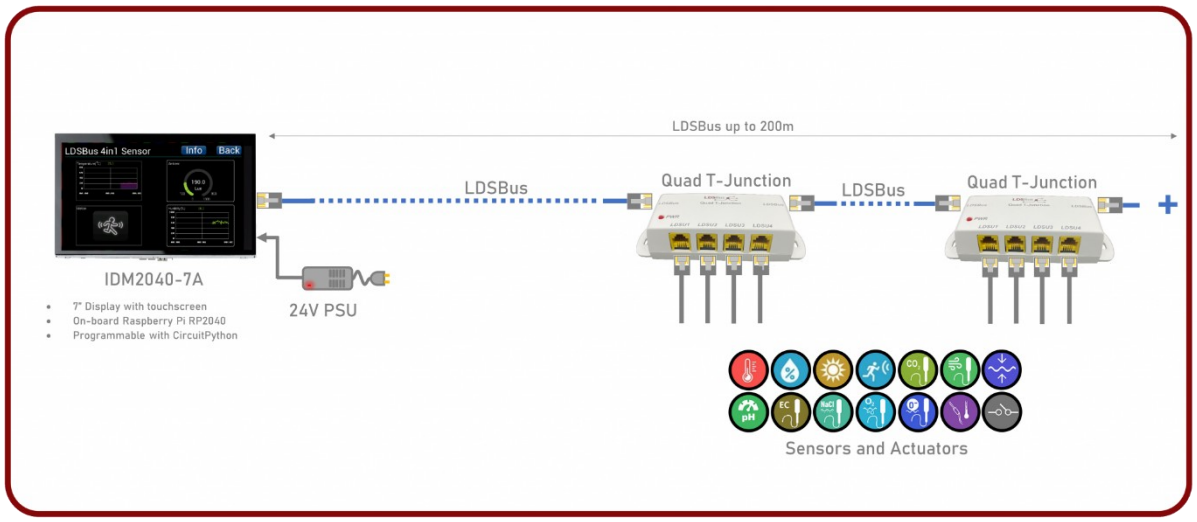


Figure 12 - IDM2040-7A based on RP2040 (Python SDK)

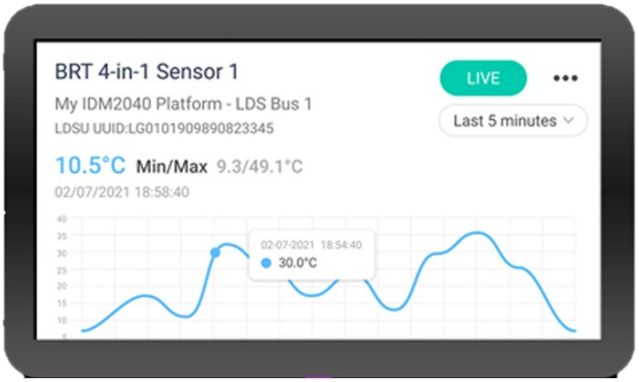


Figure 13 - IDM2040-7A provides a 7" Graphical Touch Display

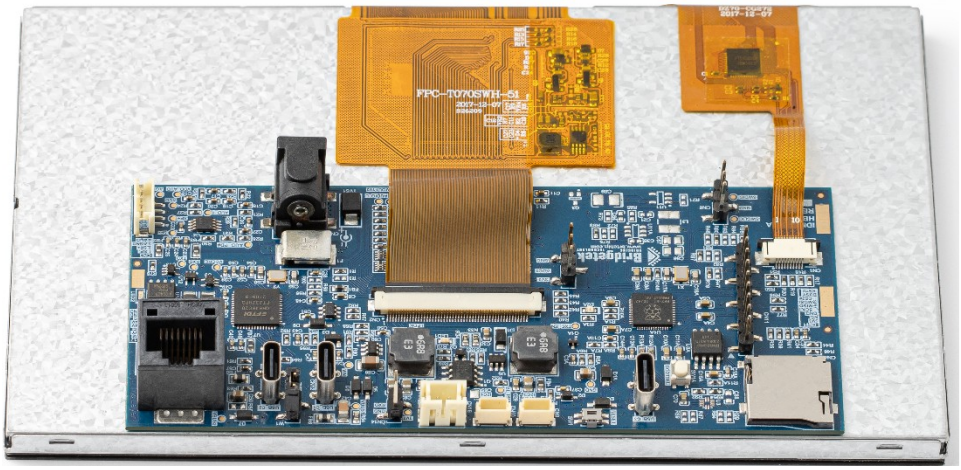


Figure 14 - IDM2040-7A rear panel showing RJ45 LDSBus connector and 24V DC input

Features of the IDM2040-7A include:

- 7" 800x480 LCD with capacitive touch screen powered by Bridgetek BT817
- RP2040 MCU with 8 MB on-board flash memory
- Programmable with CircuitPython (libraries provided)
- RJ45 connector for controlling LDSBus or DMX512 devices
- FTDI FT232HP High-Speed USB connectivity with USB Power Delivery support.
- USB Type C Ports:
- RP2040 USB DFU or debug
- FT232HP USB serial converter
- Power - USB PD charger up to 20V
- DC-jack for up to 24V PSU
- On board 16MB NOR Flash for EVE assets
- On board audio amplifier and connector for external speaker and audio line in
- Micro-SD card socket
- 2x Stemma QT (QWIIC) I2C peripheral sockets
- SPI pin headers for Adafruit Wi-Fi module or other peripherals

3.4 PanL Hub80 / PanL Hub44

The BRTSys PanL Hub80 and Hub44 come with 8 and 4 RJ45 ports respectively. These ports can be configured to run LDSBus protocol and using the LDSBus SDKs

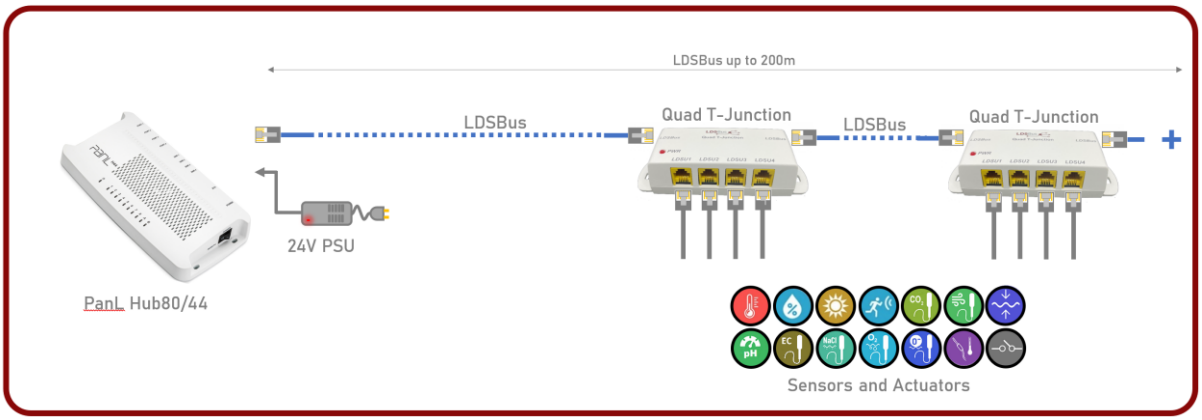


Figure 15 - Using PanL Hub44/80 to Host LDSBus Devices

The Hub44 has four RJ45 ports, which can be set to various protocols including LDSBus, Modbus and BACnet. Each port can have multiple Quad T-Junctions connected to host sensors and actuators, and supply 24V power.

Figure 16 - PanL Hub44

The Hub80 has eight RJ45 ports, which can be set to various protocols including LDSBus, Modbus and BACnet. Each port can have multiple Quad T-Junctions connected to host sensors and actuators, and supply 24V power.

Figure 17 - PanL Hub80

For more details refer to Document References for the user guide for the Hub44 and Hub80.

4 LDSBus Configuration

LDSUs require configuration before they can be used on the LDSBus. The LDSBus Configuration Utility provides an easy step-by-step tool for this purpose. This requires the LDSBus USB Adapter and is connected as shown below:

Figure 18 - LDSBus USB Adapter – LDSU Port

BRTSys have a series of calibration videos which show the procedure for calibrating our LDSBus Sensors and Sensor adapters using the LDSBus USB Adapter Videos - BRT Systems Pte Ltd.

The following video also provides more detail on how to configure LDSBus devices using the utility Unlocking BRTSys IoTPortal : How to Set Up the LDSBus USB Adapter with Ease.

5 LDSBus Sensors and Actuators

5.1 Overview

Each LDSU contains one or more microcontrollers (MCUs) which interface the sensor(s) or actuator within the LDSU to the LDSBus. The MCU performs signal oversampling and filtering as well as implementing the LDSBus slave protocol. It also updates firmware under control of the host. Beyond this, it also maintains error and diagnostic information which the host uses to monitor the health of the LDSU.

The MCU performs any processing of the data specific to the sensor or actuator (such as linearization based on calibration data or implementing dimming curves on a dimmer actuator), as well as handling the storage of calibration data where relevant as well as configuration data (such as termination on/off)

It indicates LDSU status via an RGB LED and can also flash the LED when commanded by the LDSBus to help in identifying the LDSU if multiple LDSUs of the same type are connected for example.

In the example of the sensor adapter shown below, the Quad T-Junction is connected in-line with the LDSBus and provides a tap from the RS485 data lines as well as 5V power through the RJ11/12 cable to the sensor unit. The LDSU contains the bus transceiver, power filtering and monitoring, the MCU, and the sensor IC itself. Depending on the type of sensor, the sensing itself may be on-board the LDSU or may use an external probe (in the case of the thermocouple or pH probe for example).

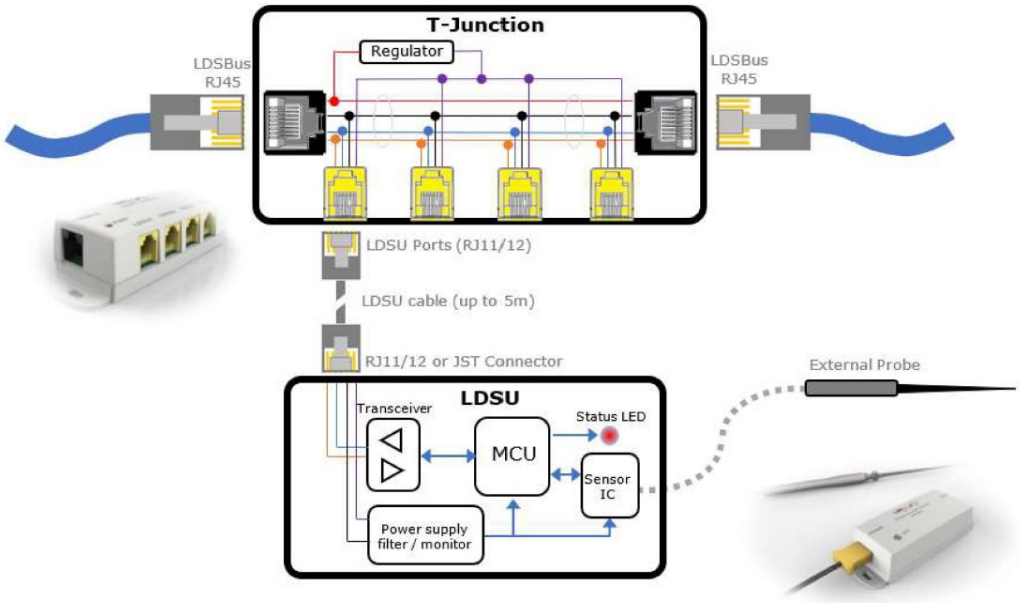


Figure 19 - Inside an LDSU (using thermocouple adapter as an example)

5.2 Air Sensors

5.2.1 Features

Air monitoring sensor units are suitable for a range of applications, and include the following features:

- Multiple sensors in one compact unit
- Flush or Swivel mounting (via swivel mount bracket)
- LDSBus power and data via single connector
- 5m cable to connect to the Quad T-Junction (supplied)
- RGB LED Indicator for at-a-glance status and identification
- Programmable address, termination and friendly name

5.2.2 Air Sensors

4in1 Sensor

- Temperature up to 70°C (±0.2°C)
- Humidity of 0 to 95% (±2%RH)
- Ambient light level (up to 64KLux)
- Passive Infra-Red (PIR) motion detection (up to 7m distance)

CO2 Multi-Sensor

- CO_2 up to 40000ppm (+/-50ppm within range 400-2000ppm)
- Temperature up to 70°C (±0.2°C)
- Humidity of 0 to 95% (±2%RH)
- Ambient light level (up to 64KLux)

CO2 Multi-Sensor (Pro)

CO_2 up to 40000ppm (+/- 40ppm within range 400-5000ppm)

Temperature up to 70°C (±0.2°C)

Humidity of 0 to 95% (±2%RH)

Ambient light level (up to 64KLux)

Air Quality Sensor

Index Air Quality 0 – 500 (+/- 15%)

Air Pressure 300 – 1100hPa (+/-0.6hPa)

Gas and True VOC Sensor

True VOC 0 – 65000 ppb (+/- 12%)

Index Air Quality 0 – 500 (+/- 12%)

5.3 Sensor Adapters

5.3.1 Features

Our range of liquid sensor adapters cover a wide range of applications from building management to agriculture, hydroponics, and aquaculture. They use an external probe (available separately) and connect to the LDSBus. The BRT Systems LDSBus Probe Specifications guide has further guidance on compatible probes. Features include:

- Measurement via external 3rd party probes
- LDSBus power and data via single connector
- 5m cable to connect to the Quad T-Junction (supplied)
- LED status indicator for at-a-glance indication and identification
- Programmable address, termination and friendly name
- Internal calibration (see our LDSBus USB adapter in section **Error! Reference source not found.**)

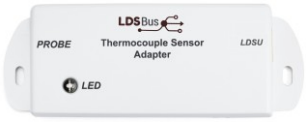
5.3.2 Liquid Sensor Adapters

pH Sensor Adapter

pH from 0-14 pH (0.01.pH resolution)

Supports 2-point calibration

BNC Probe connection



Thermocouple Sensor Adapter

Temperature from -200°C to 1372°C (+/- 0.5°C)

Linearized temperature readings

Use any K-type probe

EC Sensor Adapter

Electrical Conductivity from 0.001mS/cm to 150mS/cm (0.001mS/cm resolution)

Supports 2-point calibration

BNC probe connector

[DO Sensor Adapter]

Dissolved Oxygen measurement from 0 to 20mg/L (0.01mg/L resolution)

Supports 1-point calibration

BNC connector for probe

[ORP Sensor Adapter]

Oxygen Reduction Potential measurement from -2000mV to 2000mV

Supports 1-point calibration

BNC connector for probe

[Salinity Sensor Adapter]

Salinity measurement from 1 – 120ppt

Supports 2-point calibration

BNC connector for probe

Note: Range for all adapters depends on the probe used.

5.4 Actuators

5.4.1 Features

Output actuators allow IoTPortal to control external devices. They include a range of switching devices, with additional current measurements in some versions which allow load monitoring (for example to confirm that a device is operating and for predictive maintenance). Latching and non-latching versions of the relay actuators are available and can be selected to suit the needs of the application. Latching versions will retain their state even if the LDSBus becomes disconnected or powered off whereas non-latching versions will revert to their default state.

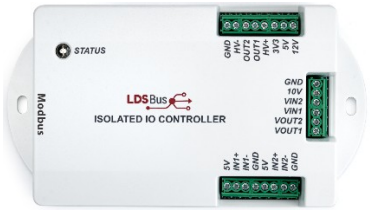
Features include:

- High current switching capability
- Current measurement capabilities (in iSENSE models)
- Latching, non-latching, solid-state and dimming versions.

- Compact enclosures with convenient terminal connections
- LDSBus power and data via single connector
- 5m cable to connect to the Quad T-Junction (supplied)
- LED status indicator
- Programmable address, termination and friendly name

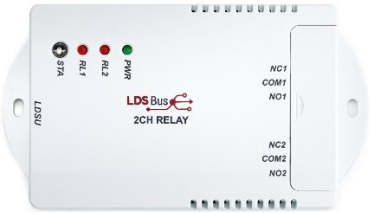
The Isolated IO controller includes both inputs and outputs making it ideal for a range of applications such as weather stations, water level measurement, controlling 0-10V dimers and interfacing to other devices via analog and digital signals. The analog inputs are ideal for connecting 4-20mA sensors to the LDSBus whilst the 0-10V capability on the analog outputs allows interfacing to 4-20mA inputs on attached devices.

5.4.2 Actuators



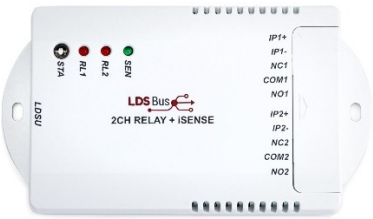
Isolated IO Controller

- Isolated inputs and outputs
- Digital: 2 inputs and 2 outputs
- Analog: 2 inputs and 2 outputs (e.g. for interfacing to 4-20mA systems)
- Multiple Voltage References (3.3V, 5V, 10V, 12V, Custom)



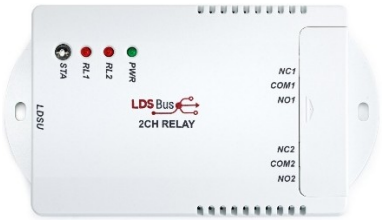
2CH RELAY

- 2 separately controlled changeover relays
- AC/DC switching up to 16A
- Latching relays maintain their state across power cycles
- Relay status indicator LEDs



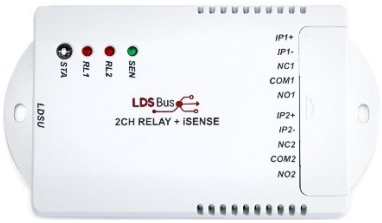
2CH RELAY + iSENSE

- 2 separately controlled changeover relays
- AC/DC switching up to 16A
- Latching relays maintain their state across power cycles
- Current sensing on each channel (up to 20A)



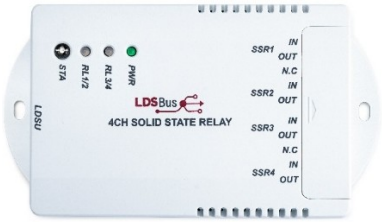
2CH NL RELAY

- 2 separately controlled changeover relays
- AC/DC switching up to 16A
- Non-latching relays return to initial NC state when power to the 2CH RELAY is off
- Relay status indicator LEDs



2CH NL RELAY + iSENSE

- 2 separately controlled changeover relays
- AC/DC switching up to 16A
- Non-latching relays return to initial NC state when power to the 2CH RELAY is off
- Current sensing on each channel (up to 20A)



4CH SOLID STATE RELAY

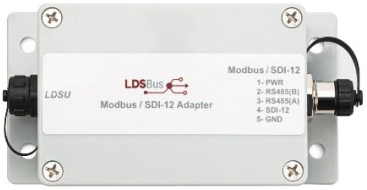
- 4 Solid-State relay (SSR) channels
- AC switching (20VAC to 240VAC)
- Up to 1.8A per relay
- Zero-crossing detection for cleaner switching

Trailing Edge Light Dimmer

- AC Trailing Edge Dimmer (550W @ 240VAC, 230W @ 100VAC)
- For dimmable LEDs and lamps
- Manual Up/Down buttons and input terminals
- Display indicates percentage dimming

5.5 Modbus/SDI-12 Adapter

The Modbus / SDI-12 adapter allows 3rd party Modbus devices to be used with LDSBus. Applications include Modbus earth/soil monitoring probes, energy meters, water meters and leak detectors.



Modbus / SDI-12 Adapter

- Soil Sensors
- Energy Meters
- Water meters
- Leak detection

6 Conclusion

The adoption of IoT will continue to grow significantly in both existing and new applications. As installations become larger and more comprehensive, and as new areas of industry begin to consider smart technology, connecting the components of these systems is one of the major challenges that engineers are facing.

The LDSBus from BRT Systems provides a highly flexible and scalable solution for connecting the components of a large-scale IoT system over long distances. The common protocol and cabling ensure interoperability between all devices on the bus, allowing a unified user interface, whilst different types of LDSBus host accommodate different application scenarios, including both local and remote monitoring and control. The LDSBus also addresses the issues of powering sensor and actuator devices by providing bus power, avoiding the need for power outlets or monitoring and replacement of batteries.

Get in touch with us at https://brtsys.com/contact-us/ to find out more about our LDSBus products and how they can help your application get better connected!

7 Contact Information

Refer to https://brtsys.com/contact-us/ for contact information.

Appendix B – References

Document References

LDSBus Configuration Utility

Unlocking BRTSys IoTPortal : How to Set Up the LDSBus USB Adapter with Ease

Videos - BRT Systems Pte Ltd

Documentation (Hubs) - BRT Systems Pte Ltd

IoTPortal Version 2.3.0 User Guides

- Introduction
- Portal Web Application (WMC)
- iOS Mobile Application
- Android Mobile Application

Acronyms and Descriptions

Terms	Description
IoT	Internet of Things
LDSBus	Long Distance Sensor Bus
LDSU	Long Distance Sensor Unit

Appendix C – List of Figures and Tables

List of Figures

List of Tables

Appendix D – Revision History

Document Title: LDSBus System Overview

Document Reference No.: BRTSYS_000220

Clearance No.: BRTSYS#157

Product Page: https://brtsys.com/components/LDSBus

Document Feedback: Send Feedback

Revision	Changes	Date
Version 1.0	Initial Release	26-02-2026