User manual for Brodersen LB2 series

INTRODUCTION TO LB2 I/O SERIES

The Brodersen LB2 modules can be used with RTU32N & RTU32M series. The I/O modules are in two parts, bottom part containing the backplane bus, and top part containing the I/O board and logic. All LB2 modules are hot plug. LB2 modules are all equipped with 200 MHz processor to process I/O, handle filtering, SOE, debounce, module clock and general module logic. Diagnostic variables are available for all LB2 modules. See the module datasheets for full info. Firmware update is handled from RTU level in Brodersen worksuite.

Use only genuine Brodersen bus cables for connection to Brodersen RTUs and extension of I/O module blocks. The connection cables for LB2 is special made to handle the power requirements and shielding to run communication. The maximum overall length of complete system is 5m. Each I/O module & Power supply module is calculated as 2 cm. The cables are as the length indicates, e.g. UCC-610/1 count as 100 cm.

Maximum possible system configuration is 60 I/O modules on one LB2 Bus.

LB2 Cables

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>100cm LB2 Cable</td>
<td>UCC-610/1</td>
</tr>
<tr>
<td>200cm LB2 Cable</td>
<td>UCC-610/2</td>
</tr>
<tr>
<td>25cm LB2 Cable</td>
<td>UCC-610/25</td>
</tr>
<tr>
<td>50cm LB2 Cable</td>
<td>UCC-610/50</td>
</tr>
</tbody>
</table>

IO MODULE BACKPLANE PART

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUS I/O module Start</td>
<td>BB21A</td>
</tr>
<tr>
<td>BUS I/O module, Middle</td>
<td>BB21B</td>
</tr>
<tr>
<td>BUS I/O module, Expansion (End)</td>
<td>BB21C</td>
</tr>
<tr>
<td>BUS Power supply module, Start</td>
<td>BB41A</td>
</tr>
<tr>
<td>BUS Power supply module, Middle</td>
<td>BB41B</td>
</tr>
<tr>
<td>BUS module for power supply, Extension</td>
<td>BB41E</td>
</tr>
<tr>
<td>BUS CPU module, Start</td>
<td>BB61A</td>
</tr>
<tr>
<td>BUS CPU module, Middle</td>
<td>BB61B</td>
</tr>
<tr>
<td>BUS CPU module, Redundant</td>
<td>BB61R</td>
</tr>
<tr>
<td>BUS module for SYS-I/O, Start</td>
<td>BB81A</td>
</tr>
<tr>
<td>BUS module for SYS-I/O, Middle</td>
<td>BB81B</td>
</tr>
</tbody>
</table>

LB2 Modules

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20DI, bipolar 10-30 VDC</td>
<td>DI20A</td>
</tr>
<tr>
<td>20DI, bipolar 30-60 VDC</td>
<td>DI20B</td>
</tr>
<tr>
<td>18DI, 2CI 5kHz, bipolar 10-30 VDC</td>
<td>DI20C</td>
</tr>
<tr>
<td>12DI, unipolar 90-140 VDC</td>
<td>DI12H</td>
</tr>
<tr>
<td>10DI bipolar 10-30 VDC, 10DO 10-30VDC</td>
<td>DM20A</td>
</tr>
<tr>
<td>10DI, bipolar 30-60 VDC, 10DO 10-30VDC</td>
<td>DM20B</td>
</tr>
<tr>
<td>8DI, 2CI, 5kHz bipolar 10-30 VDC, 10DO 10-30VDC</td>
<td>DM20C</td>
</tr>
<tr>
<td>12RO, SPST</td>
<td>DO12R</td>
</tr>
<tr>
<td>8RO, SPDT</td>
<td>DO08R</td>
</tr>
<tr>
<td>20DO 10-30VDC</td>
<td>DO20A</td>
</tr>
<tr>
<td>8AI 16 bit user configurable</td>
<td>AI08A</td>
</tr>
<tr>
<td>2AO 16 bit user configurable</td>
<td>AO02A</td>
</tr>
<tr>
<td>8 DI, 2 DO, 3AI (Current), 1 AO</td>
<td>IO14A</td>
</tr>
<tr>
<td>8 DI, 2 DO, 3AI (Voltage), 1 AO</td>
<td>IO14B</td>
</tr>
<tr>
<td>Power supply 10-30 VDC, 12VDC 1.2A BUS output</td>
<td>PS24A</td>
</tr>
<tr>
<td>CPU Module</td>
<td>MP32A</td>
</tr>
</tbody>
</table>

DESIGNING A SYSTEM WITH LB2 I/O MODULES

In the following scenarios is only one type I/O module with 10 digital Input & 10 Digital output selected, with part-nr. DM20A. Only one type is chosen in the examples to make the illustrations more simple.
**RTU32M System with backplane CPU & I/O modules.**
For a backplane CPU system the first module is always CPU, second is always Power supply. Third module can be redundant power supply or I/O module.

Example I/O order would be.
1 x CPU module MP32A  
2 x Power supply module PS24A  
7 x I/O module DM20A (10DI+10DO)  
1 X Bus CPU module Start BB61A  
2 X Bus PS module Middle BB41B  
7 X Bus I/O module Middle BB21B

**RTU32N System with one I/O module.**
For a single module system BB21A and a UCC cable is needed. BB21A has a RJ-45 connector to connect the CPU module and a possibility to connect to another module.

Example I/O order would be.
1 x I/O module DM20A (10DI+10DO)  
1 X Bus I/O module Start BB21A  
1 x 25cm LB2 Cable UCC-610/2

**System with multiple I/O modules example 1.**
(Overall bus length max 5m)
When a multiple I/O configuration is engineered the power consumption must be considered. See the datasheet for the RTU or the power supply module to calculate how many I/O modules that can be connected before extra power supply modules BB-1PI.10 or BB-1PS.10 is needed. This configuration gives the possibility to add more I/O on next Din-rail. I/O modules can always be inserted in between start and end module. The UCC Cable in end module is not needed, it is to illustrate future possible expansion.

Example I/O order would be.
9 x I/O module DM20A (10DI+10DO)  
1 X Bus I/O module Start BB21A  
1 X Bus I/O module Expansion BB21C  
7 X Bus I/O module Middle BB21B  
1 x 25cm LB2 Cable UCC-610/25

**Figure 1**

**Figure 2**
System with multiple I/O modules example 2.
(Overall bus length max 5m)

When a multiple I/O configuration is engineered the power consumption must be considered. See the datasheet for the RTU or the power supply module to calculate how many I/O modules that can be connected before extra power supply modules BB41E or BB41A is needed.

Example I/O order would be.
17 x I/O module DM20A (10DI+10DO)
2 X Bus I/O module Start BB21A
2 X Bus I/O module Expansion BB21C
13 x Bus I/O module Middle BB21B
1 x 25cm LB2 Cable UCC-610/25
1 x 100cm LB2 Cable UCC-610/1

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**ASEMBLE BUS I/O MODULES**
Backplane modules are assembled by gently pressing them together with hands, no tools needed. See Figure 4

**DISASSEMBLE BACKPLANE MODULES**
If two backplane modules needs to be disassembled, use a flathead screwdriver. Push it gently in between the backplane modules and rotate gently like shown on Figure 5.

**INSERT MODULE INTO BUS BACKPLANE**
Gently slide module into backplane part. See Figure 6

**************Attention**************
Modules in Table 1 has a different backplane connector location. I/O modules and CPU module cannot be inserted by mistake into a power supply backplane module.

**Table 1**
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BUS Power supply module, Start.</strong></td>
<td><strong>BB41A</strong></td>
</tr>
<tr>
<td><strong>BUS Power supply module, Internal.</strong></td>
<td><strong>BB41B</strong></td>
</tr>
</tbody>
</table>
Remove module from backplane module

Take out module
Push down + pull out.

Backplane & I/O module side view
Backplane bus connector located in the circle marked with D.

Backplane & I/O module top view

Backplane start & Expand with I/O module
**Backplane Start:**
Backplane start has a RJ45 connector for connecting I/O modules to RTU if the solution not is with CPU mounted in the backplane.

**Backplane Expand or End module**
The Expand module is also the End module. The Expand module has RJ45 connector for Backplane bus expansion. It can be for expansion to next cabinet or for future possibility for expanding the solution. Maximum overall system length is 5 meter.

Part nr. for backplane module (not IO module)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bus I/O module Start</strong></td>
<td>BB21A</td>
</tr>
<tr>
<td><strong>BUS I/O module, Expansion (End)</strong></td>
<td>BB21C</td>
</tr>
</tbody>
</table>
Backplane middle with I/O module

![Figure 11](image1)

Part nr. for backplane module middle (not IO module)

| BUS I/O module, Internal (middle) | BB21B |

Backplane Power Supply

The backplane power supply cannot be inserted into any other backplane modules than BB41A, BB41B & BB41E. The connector on the backplane is located in a different position for avoid inserting I/O cards into the Power supply backplane module. The power supply can be redundant like all the rest of the modules, and has a 200 Mhz processor to handle all the logic on the module.

![Figure 12](image2)

Part nr. for backplane module middle (not IO module)

| BUS I/O module, Internal (middle) | BB21B |

**EMC/LVD:**
- IEC61000-3-2:2000
- IEC61000-3-3:1995+A1
- EN55022:1998 Class A
  - EN55024:1998+A1+A2
- IEC60950-1:2003 Safety requirements for electrical equipment for measurement and control

**Climatic:**
- Dry heat: IEC 60068-2-2, Test Bd, Temp. +55°C, Duration 8h
- Cold: IEC 60068-2-1, Test Ad, Temp. -10°C, Duration 8h
- Damp heat: IEC 60068-2-3, Test Ca, Temp. 40°C, RH 95%, Duration 8h

**Mechanical:**
- Vibration: IEC 60068-2-6, Test Fc (sinusoidal), Freq. 10-150Hz, Amp. 4g, 5 sweeps in 3 orthogonal axes
- Shock: IEC 60068-2-27 (half sine), Acc. 15g, Pulse time 11 msec, 3 x 6 shocks
MODULE CONFIGURATOR

All modules are configured in the Brodersen worksuite. It is recommended to see our video about how to configure and insert LB2 modules in I/O system. It can be found on our webpage or by pressing this link: VIDEO

Module configurator Toolbar

Figure 13 shows the configurator toolbar with icon explanations.

- Insert new module
- Remove module
- Move module Left
- Move module right
- Upload Configuration
- Insert Variable
- Move Down
- Move Up
- Sort Symbols
- Iterate property
- Set Variables in Module
- Set Status Variable
- Set all offsets
- Remove all Variables in module
- Declare Variables in database
- Disable Configuration
- Import Variables
- Export Variables

Inserting a module in Brodersen Worksuite

To open the I/O configurator press the ICON in the top menubar “open I/Os”.

The I/O configurator is now open.

Modules can be inserted in several ways.
- Left click in the I/O module window and select “Upload Configuration” This will upload modules connected to the online RTU.
- Left click in the I/O module window and select ADD Module
- Drag and drop from module list in the right side of I/O module window
- A existing module can be copied by “Ctrl+c” & “Ctrl + V” → Windows copy paste

Move a module in Brodersen Worksuite

- Modules can be moved left or right by pointing the mouse cursor on the module, press and hold left mouse button and drag module to desired position.
- Modules can be moved left or right by pointing the mouse cursor on the module, press right mouse button and select “Move Right” or “Move Left”

Remove a module in Brodersen Worksuite

- Modules can Removed/Deleted by pointing the mouse cursor on the module, press right mouse button and select “Remove Module”
- Modules can Removed/Deleted by pointing the mouse cursor on the module and press Delete on keyboard
Add variables to a module in Brodersen Worksuite

In left pane of the I/O modules press the Icon “Set Variables In Module” a Set variables window appears. Remember to check Declare Variables in Database if Variables are to be used later as Global Variables. Use the Drop Down list to select a syntax, or make you own.

Remember to check Declare Variables in Database if Variables are to be used later as Global Variables.

Use the Drop Down list to select a syntax, or make you own.

If as an example the syntax $(SLOT)_$(OFFSET)_VAR is selected the variables will be like in Figure 16 for a 8 Analogue input module.

The way the syntaxes are built, give the flexibility to engineer your own. If the syntax is modified it could be:

Module_Nr_$(SLOT)_Analogue_in_$(OFFSET)

And the result would be see Figure 17

Rename auto generated variables

In some cases there are some variables names that can’t be generated through a syntax. In this case point the mouse on the variable see Figure 17 where the line is blue. Double click on it. And Figure 18 appears.

Now the variable name can be changed to temperature of motor 221 e.g. Temp_Motor_221, press OK and Figure 19 appears. Remember in Figure 19 to select “Rename the Variable”
Configure Modules
This document is a general document for all modules, and there will be new features on modules. Use the datasheet of the modules to see what specific features there is available on the module. In this example a combination module and an analogue input module will be shown. In the module configurator see Figure 20 DoubleClick on a module

After DoubleClick on the module the configuration page appears. See Figure 21.

Configure Combination DI/DO module example

In this illustration a Combination module with 10 DI and 6 DO has been selected.
- Configure Input:
  - Inverted: Select if input is Low level inverted. Can also be inverted in the PLC logic.
  - Counter: Select if input is a counter. If an input is a 5 Khz counter, but not defined as a counter. Then the bus will be spammed with 5000 pulses/sec. equal to a pulse every 200 µs.
  - Debounce: Debounce in milliseconds, determines how long time the I/O must be high or low before it is detected as state change.
  - Fault Mode: Fault mode is where module has no contact with a CPU. It is necessary to select for all channels.
    - Keep (I/O module will keep last state)
    - Low (Output will be forced Low)
    - High (output will be forced High)
Configure AI module example
In the module configurator see Figure 20 DoubleClick on a module

After DoubleClick on the module the configuration page appears. See Figure 22

- Configure Analogue Input:
  - **Range:** Select input type for each channel in dropdown menu.
  - **Filter:** Select filter type for each channel in dropdown menu. See Figure 23
  - **Delta change:** See AI module datasheet
  - **Scale Min:** See AI module datasheet
  - **Scale Max:** See AI module datasheet

Firmware update I/O modules
Firmware update of LB2 modules is done through Brodersen Firmware updater. Firmware version is displayed in Brodersen worksuite. Check [www.brodersen.com](http://www.brodersen.com) for new firmware releases or contact support at [support@brodersen.com](mailto:support@brodersen.com)

Export/Import Module variables.

**Export:**
Select the I/O module and press Export Variables, see Figure 13. Now the CSV export file can be edited in EXCEL. Scale min, Scale Max, Variable name etc.

**Import:**
Press the Import Variables see Figure 13. Select the CSV file and import.
STANDARDS
EMC/LVD:
- IEC61000-3-2:2018
- IEC61000-3-3:2013
- EN55011:2009
- IEC61000-4-12:2006
- IEC61000-4-13:2002+ADM2015
- IEC61000-4-17:1999+AMD:2008
- IEC60950-1:2005+AMD1:2009+AMD2:2013 Safety requirements for electrical equipment for measurement and control

Climatic:
Dry heat: IEC 60068-2-2:2007, Temp. +70°C, Duration 72h
Cold: IEC 60068-2-1:2007, Temp. -40°C, Duration 72h
Damp heat cyclic: IEC 60068-2-30:2005, Temp. 25°C to 70°C, RH 98%, Duration 8h

Mechanical:
Vibration: IEC 60068-2-6:2007, Test Fc (sinusoidal), Freq. 10-150Hz, Amp.4g, 5 sweeps in 3 orthogonal axes
Shock: IEC 60068-2-27:2008 (half sine), Acc. 15g, Pulse time 11 msec, 3 x 6 shocks

Module status LED flashing codes.
A two color (red/yellow) LED is provided on the module. This indicates the module status with different blinking patterns. The yellow is indicating module mode (run, stop). The red indicate module error or warnings. Each pattern / color will operate in 2 sec duty cycles. When the red LED is inactive (off), only the 2 sec yellow duty cycle will operate (yellow is always active). When the red LED is active, a switch between 2 sec yellow, and 2 sec red patterns will occur. These patterns are possible:

Yellow I/O module LED Codes:

<table>
<thead>
<tr>
<th>Yellow LED</th>
<th>Pattern Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No module power</td>
</tr>
<tr>
<td>on</td>
<td>Module is Operational mode.</td>
</tr>
<tr>
<td>Blinking</td>
<td>Module is in Operational Timeout, caused by missing RTU heartbeat &quot;timeout from CPU to I/O module&quot;. Outputs will be managed according to failsafe configuration (Last state, forced On, forced Off)</td>
</tr>
<tr>
<td>Flickering</td>
<td>NA</td>
</tr>
<tr>
<td>Single Flash</td>
<td>No valid node ID. Normal after power up.</td>
</tr>
<tr>
<td>Double Flash</td>
<td>Module is assigned a valid node ID, and is Stopped.</td>
</tr>
<tr>
<td>Triple Flash</td>
<td>NA</td>
</tr>
<tr>
<td>Quadruple Flash</td>
<td>Module is in firmware update mode.</td>
</tr>
</tbody>
</table>

RED I/O module LED Codes:

<table>
<thead>
<tr>
<th>Red LED</th>
<th>Pattern Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No warnings or errors.</td>
</tr>
<tr>
<td>on</td>
<td>Module LB2 communication error.</td>
</tr>
<tr>
<td>Blinking</td>
<td>A number of LB2 communication errors has occurred, which has caused the LB2 error counters to reach the error level. The module will automatically stop any transmission on the bus, to prevent LB2 bus corruption for other modules (nodes). The module will still listen for NMT commands, and a communication reset command will reconfigure module configuration / communication, if the error was temporary.</td>
</tr>
<tr>
<td>Flickering</td>
<td>Corrupted module information / calibration data in eeprom. Fatal error</td>
</tr>
<tr>
<td>Single Flash</td>
<td>Module communication error warning. A number of LB2 communication errors has occurred, which has caused the LB2 error counters to reach the warning level. A number of successful communications will automatically reset this warning.</td>
</tr>
<tr>
<td>Double Flash</td>
<td>NA</td>
</tr>
<tr>
<td>Triple Flash</td>
<td>NA</td>
</tr>
<tr>
<td>Quadruple Flash</td>
<td>NA</td>
</tr>
</tbody>
</table>

Module LED pattern

<table>
<thead>
<tr>
<th>LED</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>LED is constantly off</td>
</tr>
<tr>
<td>on</td>
<td>LED is constantly on</td>
</tr>
<tr>
<td>Blinking</td>
<td>LED is flashing, 200 ms on, 200 ms off</td>
</tr>
<tr>
<td>Flickering</td>
<td>LED is flashing, 50 ms on, 50 ms off</td>
</tr>
<tr>
<td>Single Flash</td>
<td>LED pattern is, 200 ms on, 1800 ms off</td>
</tr>
<tr>
<td>Double Flash</td>
<td>LED pattern is, 200 ms on, 200 ms off, 200 ms on, 1400 ms off</td>
</tr>
<tr>
<td>Triple Flash</td>
<td>LED pattern is, 200 ms on 200 ms off, 200 ms on 200 ms off, 200 ms on 1000 ms off</td>
</tr>
<tr>
<td>Quadruple Flash</td>
<td>200 ms on 200 ms off, 200 ms on 200 ms off, 200 ms on 200 ms off, 200 ms on 600 ms off</td>
</tr>
</tbody>
</table>