The GreenBus™ network
and use of the GBDT
(GreenBus Diagnostic Tool)

Excellum
EXCELLENT LIGHTING, SAVING ENERGY

GENERAL SYSTEM LAYOUT

Please refer to the attached drawing “C2-ELM-NETWORK-LAYOUT” for the general system layout.

PREPARATION

1. First read the manuals of the IO modules and follow these instructions.
2. Do not work on live components. Prior to installing components or making connections, switch off all mains supplies. Check that also UPS or emergency power is disconnected!
3. Prior to any work, make sure you fully understand and are able to follow the instructions.

DESCRIPTION OF THE GREENBUS

The GreenBus™ cable consists of 4 UTP pairs (Unshielded Twisted Pair) Cat. 3 cables with a minimum cross section of AWG24. More expensive Cat 5/5e/6 or still higher categories are not needed. A Cat 5/5e cable can also be used. Please note that all specifications have been drawn up for the use of Cat. 3 cables AWG24 and that cables from a higher category have more twists per metre, so that their resistance/capacitance per running metre is higher and their maximum length is correspondingly shorter.
The absolute maximum total length per channel is 450m. During installation, proper functioning must be checked for each individual channel and, if necessary, split up to reduce the distance to the ECU if signal quality is insufficient.

Caution: install the cables in compliance with all local standards and regulations, which may differ from country to country and even from region to region. The standard versions contain PVC insulation; if “Low Smoke Zero Halogen” types are required by local regulations, these can be supplied upon request.

CAUTION – WARNING – IMPORTANT

THE GREENBUS MUST BE COMPLETELY INSTALLED AND TREATED AS A SELV CIRCUIT (SELV=SAFETY EXTRA LOW VOLTAGE).

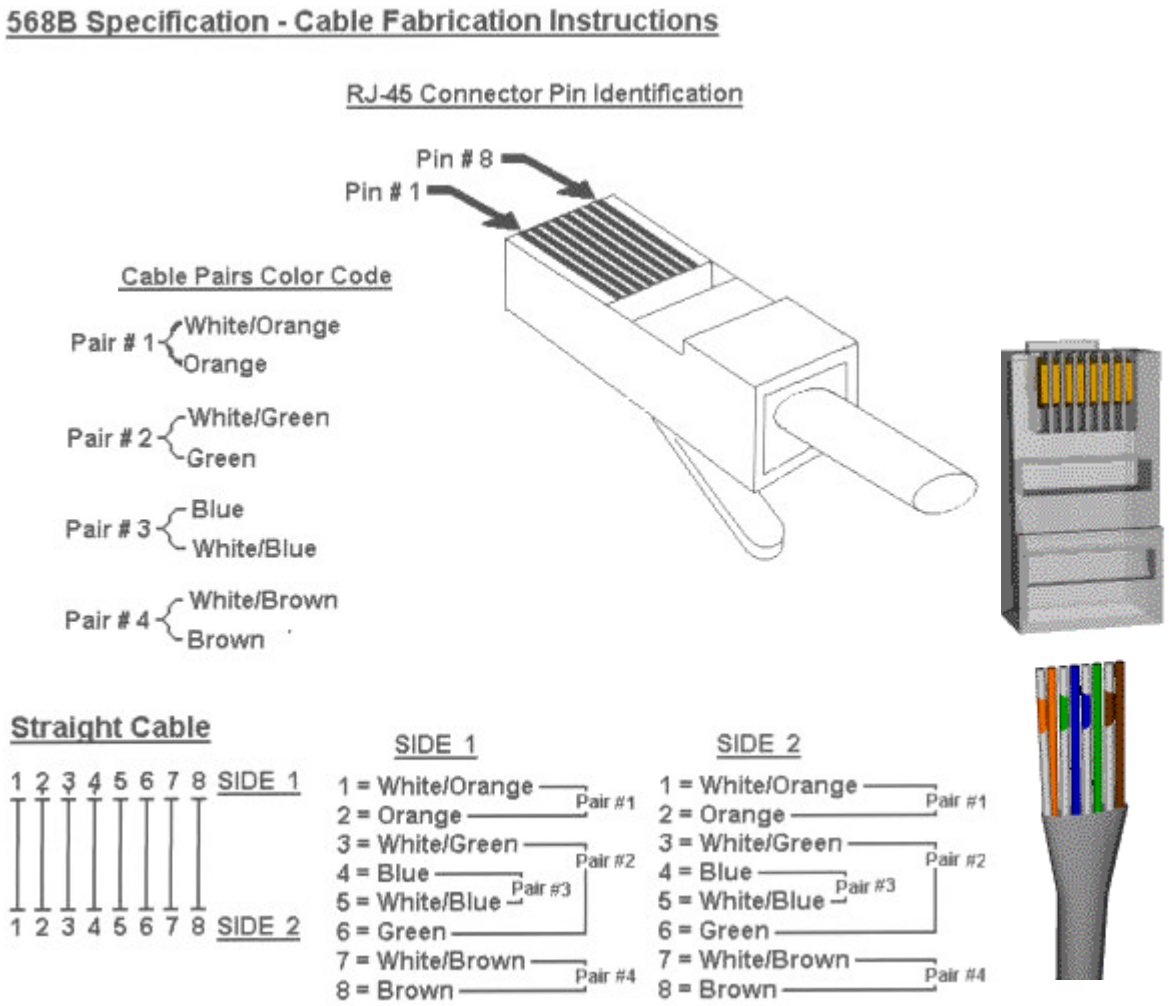
THE GREENBUS MUST THEREFORE ALWAYS BE ADEQUATELY ISOLATED FROM THE MAINS VOLTAGE OR OTHER HIGH VOLTAGES.

THE RULES FOR THIS DIFFER FROM COUNTRY TO COUNTRY. REFER TO LOCAL REGULATIONS AND CONTACT A RECOGNISED INSPECTION BODY IN CASE OF DOUBT

The cables are on both sides equipped with RJ45 modular connectors and connected straight through according to TIA/EIA-568 specifications. Both T568A and T568B can be applied, provided the connection is one-to-one (i.e. cross-over cables are not accepted).

Preferably use prefab cables, one of the main causes of faults and defects are cables made on site. If you nevertheless want to crimp an RJ45 connector onto a cable, make sure to check it with a network cable tester before you use the cable in the system.

The correct connection is shown in the following figure.



The GreenBus™ uses the 4 pairs as follows:

Pins 1 and 2: Communication
Pins 3 to 6: 24VDC (-)
Pins 7 and 8: 24VDC (+)

CHECKING THE INSTALLED GREENBUS WITH THE GBDT

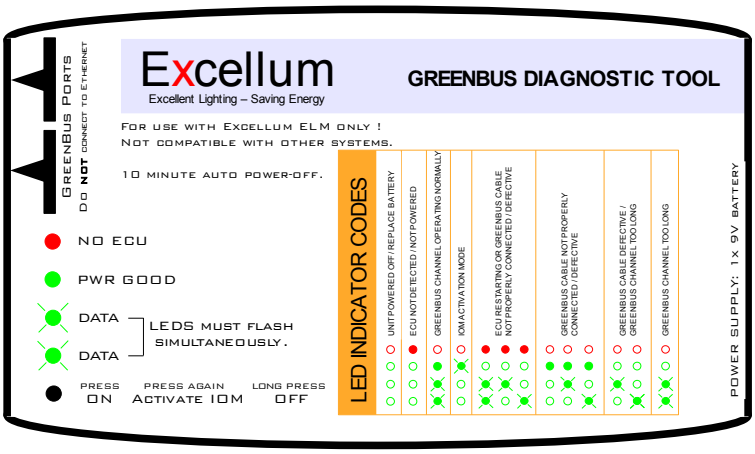
The GBDT (GreenBus™ Diagnostic Tool) has two functions:

- Verifying the proper signal quality of the ECU up to and including the last module on a GreenBus™ channel
    - Activating an individual luminaire module (closing the relay contacts) if this contact has been shifted into the OFF position during transport (to minimise energy consumption, bistable relays are applied which only consume energy when they are switched; during transport the position of the contacts can change as a result of shocks, this will not occur during normal use)

Connecting the GreenBus™ Diagnostic Tool:

- The tool has its own energy supply in the form of a 9V monoblock battery. To save battery capacity, the tester automatically switches off after 10 minutes.
- Two RJ45 ports are present on the front of the device. The GreenBus™ cables may be connected to one or both ports, the ports are connected to each other on a pin-by-pin basis.

WARNING
NEVER CONNECT ETHERNET TO THE TESTER
BOTH THE TESTER AND THE ETHERNET EQUIPMENT
MAY BE DAMAGED



Use for switching on the luminaire modules:

- Luminaire modules have one or more relay contacts which are supplied standard in the ON position (relay contact closed). The relay contact may shift into the OFF position due to vibrations or shocks during transport. In such a case, the luminaire that is connected to the module will not light until the system has been connected to the ECU. To remedy this, the GBDT can activate the internal relay as follows:
    1. Press the button to switch on the GBDT (the GBDT is now in “diagnostic mode”)
    2. Connect the GBDT to <u>one</u> luminaire module
    3. Press the button again to select the “activate IOM mode”. The PWR GOOD LED (see above figure) will flash.
    4. Wait until the luminaire lights up (you can hear and/or feel the relay click) or

until the PWR GOOD LED no longer flashes (this takes approx. 15 seconds). If the luminaire does not light up, check whether all connections are OK. If everything else is OK, the luminaire module is defective. Disconnect all supply voltages from the luminaire before replacing the luminaire module with a new one.

Use for testing the GreenBus™ channels:

- General
  - Automatic protection of the ECU

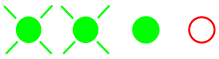
    ECUs may temporarily go into safe mode when several modules are connected or disconnected simultaneously to or from a channel. Note that after making or breaking connections on a channel it may take up to 1 minute before the ECU automatically exits safe mode. No test can be carried correctly out as long as the ECU is in safe mode. When in doubt, you can check the green status LED in the middle of the ECU front panel: if the ECU is in standard mode, it flashes rapidly (>4Hz). If the LED is off or flashes slowly (~1Hz), the ECU is not in standard mode.
  - Test point with respect to the ECU

    If you connect the GBDT somewhere in the middle of a channel, one end will be connected to the ECU and the other will not. Therefore, a green PWR GOOD LED should be displayed at one end and a red NO ECU LED at the other end. If a NO ECU LED is displayed at both ends, you should check whether the ECU is on, not in safe or start-up mode, and all connections are in place. If a PWR GOOD LED lights up at both ends, this indicates a closed loop. You must then first remedy this condition, because a closed loop is not allowed. Please be aware of this fault as it is the only way in which it can be identified with the GBDT; both ends seem to test OK, but when you close the loop again after testing the unit will not function properly.

- Test instruction
  - Initial test of a GreenBus™ channel

    IMPORTANT: this test must always be carried out first on a channel before the channel is connected permanently, in order to avoid damage to the ECU or modules caused by cable faults

    1. Press the GBDT button once to start the GBDT in “diagnostic mode”. The red NO ECU LED lights up (if not, replace the battery).
    2. Connect 1 port of the GBDT to an ECU GreenBus connector, the GBDT LEDs light up as follows:

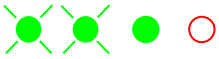
       

       Check that both DATA LEDs flash simultaneously and the PWR GOOD LED is on.
    3. Then connect the GreenBus™ channel to be tested to the other RJ45 port of the GBDT, and check that the indication is still OK or is restored as soon as the status LED of the ECU flashes rapidly, or after 2 minutes at the latest; if this is not the case, there is a short circuit somewhere in the circuit and you must immediately disconnect the GreenBus™ from the ECU and locate the faulty cable or module. Do not permanently connect the GreenBus™ to the ECU before this fault condition has been resolved!

- Validation test for a GreenBus™ channel
  1. Press the GBDT button once to start the GBDT in “diagnostic mode”. The red NO ECU LED lights up (if not, replace the battery).
  2. Connect the GBDT to the end of the GreenBus™ channel, behind the last module on the line.

     CAUTION: the shortest total cable length is normally obtained by daisy chaining all modules (daisy chaining) and is the preferred layout, also for fault diagnosis and later extensions. If, however, you have used branches (which is functionally allowed), you must test the end of EACH branch!

     If this branch of the GreenBus™ channel is OK, the GBDT LEDs light up as follows:

     Check that both DATA LEDs flash simultaneously and the PWR GOOD LED is on.
  3. Before you validate a channel and request commissioning of the system, you must check and validate each end of each channel of each ECU in this way. If other test results are obtained, you should proceed as described in the following paragraph.

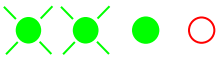
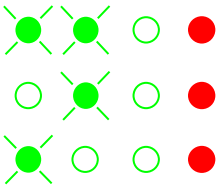
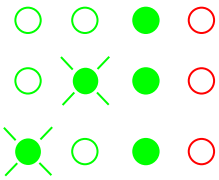
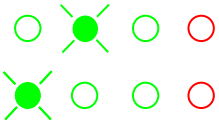
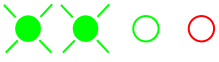
- Fault location with the GBDT

  The GBDT can indicate the presence of a fault, but an iterative process is needed to locate the fault. The fastest method to locate a fault is the “divide into 2” method as described below:
  1. When you receive a fault indication, you first check just before the first module on a channel; if everything is OK there, the ECU is also OK.
  2. If there are branches, you first check just before and just after the branches.
  3. Divide the branch of the GreenBus™ channel with the fault into 2 more or less equal parts, and check at this location; if the part from the ECU to here is OK, you restore the connection at this location and move up about half of the remaining branch downstream from the ECU. If the first part is NOK, you move up about half in the direction of the ECU. Repeat the process until you known at which module or cable the fault originates.
  4. Now that you have located the problem, a number of possibilities remain. In most cases, the faulty component will be the one after which the fault indication is obtained. If possible, double check this by bypassing this component (using a new cable or, in the case of a module, a coupling piece, a loose module or a longer cable between the previous and the next module). Check 5 or so modules further downstream whether everything is OK. This procedure is recommended because faults (especially cable faults) sometimes occur a few positions before the location where the fault is noticed. If, however, with bypassing a good test result is still obtained 5 or so modules further downstream, you will be more certain to have located the faulty component. Depending on the case, proceed as follows:
     i. The problem is located in a module: make sure that the mains voltage is completely disconnected from the module, and then replace the module with a new one;
     ii. The problem is located in a cable: replace the cable with a new one (note: inexpensive and good quality UPT cable testers are commercially available; if you doubt the quality of a cable, it is best to check the cable with such a cable tester); WARNING: never try to

repair a cable with incorrectly crimped modular connector by crimping it again, such a cable may produce good test results but is likely to cause problems in the medium term);

5. Check whether the channel is OK (or better still at least 5 modules downstream) to make sure that the fault in this part has been remedied.
6. Mark the faulty component in a clearly legible, unique (sequence number) and indelible manner. Note down the conditions observed on site (place, appearance, anomalies, etc.), so that you will later know what has been replaced how and why. Remove faulty components immediately from the work area to prevent their reuse.
7. Repeat these steps until all GreenBus™ channels test OK before commissioning is started or requested.

OVERVIEW OF GBDT LED INDICATIONS AND ACTIONS TO BE TAKEN

LED INDICATION	MEANS	ACTIONS TO BE TAKEN
	GBDT NO POWER	Switch on the GBDT; if none of the LEDs light up, replace the battery with a new one. If still no LED lights up, the GBDT is faulty.
	NO ECU	First check whether the ECU is on and in normal mode. If this is the cable going towards the ECU, there is either an interruption or the total length of the GreenBus channel is too long. Interruptions can be caused by 'forgotten' connections, faulty cables, faulty modules or wrongly inserted connectors.
	GB OK	If both DATA LEDs flash simultaneously, the line is OK.
	IOM ACTIVATION MODE	This indication is obtained when you press the ON button while the GBDT is already switched on. The GBDT is then in a special mode which allows you to switch on one luminaire module at a time in case the relay of that module was switched of during transport. Do not use this mode when testing the GreenBus.
	ECU RESTART OR CABLE FAULT	The ECU is probably starting up. Wait one minute; if still not OK, a cable fault is likely to be present. For this type of fault it is important to check, as soon as you have identified the probable location, whether it is located in the last cable before the fault or a few cables back.
	CABLE FAULT	This is a cable fault. For this type of fault it is important to check, as soon as you have identified the probable location, whether it is located in the last cable before the fault or a few cables back.
	CHANNEL TOO LONG OR CABLE FAULT	If this fault appears at the end of a line, the line is probably too long. Redistribute the modules over the GreenBus channels (if necessary, use a splitter, which is not recommended as splitters are often themselves the cause of bad connections)
	CHANNEL TOO LONG OR TOO MANY NODES	The total length of the line is too long or there are too many modules connected to one line. Redistribute the modules over the GreenBus channels. If you used cables with different specifications (CAT3 UTP AWG24 is standard), the maximum resistance and capacitance may already be reached with shorter lengths.

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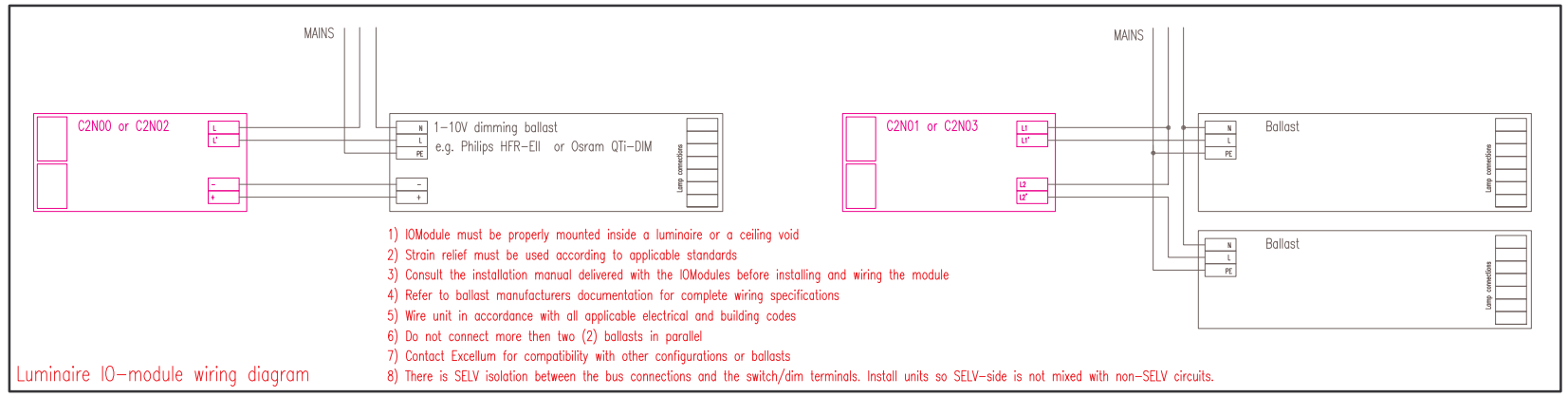
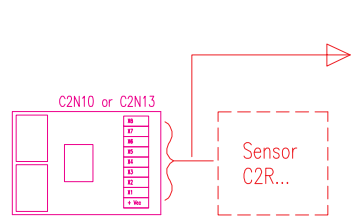


Luminaire IO–module wiring diagram

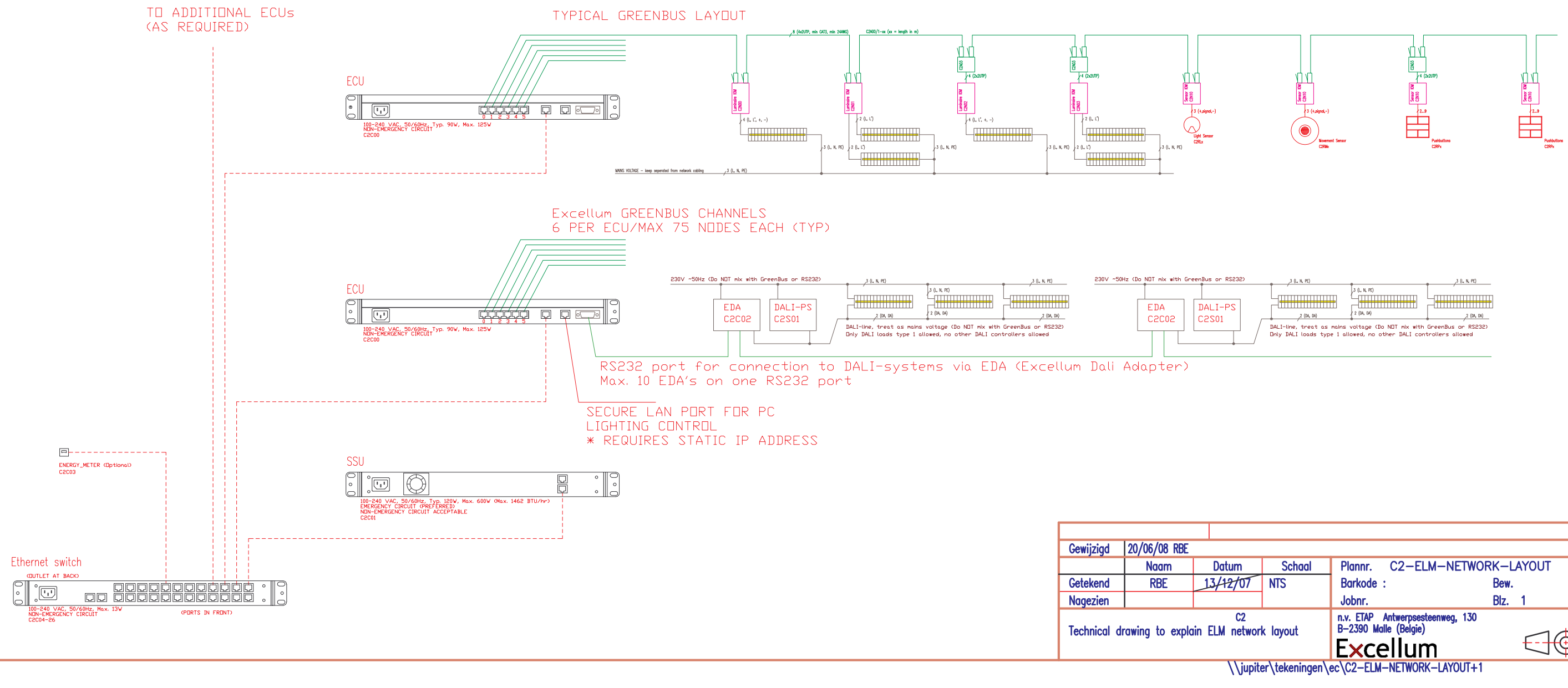
1) IOModule must be properly mounted inside a luminaire or a ceiling void
2) Strain relief must be used according to applicable standards
3) Consult the installation manual delivered with the IOModules before installing and wiring the module
4) Refer to ballast manufacturers documentation for complete wiring specifications
5) Wire unit in accordance with all applicable electrical and building codes
6) Do not connect more then two (2) ballasts in parallel
7) Contact Excellum for compatibility with other configurations or ballasts
8) There is SELV isolation between the bus connections and the switch/dim terminals. Install units so SELV–side is not mixed with non–SELV circuits.



C2N10 C2N13 Sensor IOM	C2RL2 Light Sensor	C2RM0 PIR Sensor Recessed	C2RM1 PIR Sensor Surf. mnt	C2RM2 PIR+US Sensor Surf. mnt	C2RM3 PIR Sensor Wall mnt	C2RP2 Push Button Panel	C2RP4 Push Button Panel	C2RP6 Push Button Panel
X8								
X7								
X6								F
X5								E
X4							D	D
X3							C	C
X2	– (2)	Black (2)	Black (4)	Black (4)	– (2)	B	B	B
X1	–> (3)	Blue (6)	Blue (3)	Blue (3)	–> (4)	A	A	A
+Vcc	+ (1)	White (1)	Red (1)	Red (1)	+ (1)	C1	C1	C1

Sensor IOmodule wiring diagram

1) IOModule must be properly mounted inside a luminaire, ceiling void or distribution box according to your local electrical and building codes.
2) Strain relief must be used according to applicable standards
3) Consult the installation manual delivered with the IOModules before installing and wiring the module
4) Refer to sensor wiring instructions for complete wiring specifications
5) Wire unit in accordance with all applicable electrical and building codes
6) Do not connect sensors in parallel
7) Contact Excellum for compatibility with other configurations or sensors
8) Sensor IOModules en sensors are to be used in SELV circuits only, do not mix with mains circuits.



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	Naam	Datum	Schaal
Getekend	RBE	~~13/12/07~~	NTS
Nagezien			

Plannr. C2–ELM–NETWORK–LAYOUT
Barkode :
Bew.
Jobnr.
Blz. 1

C2
Technical drawing to explain ELM network layout

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Excellum

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