ELECTRONIC ENGINEERING

Date : 01-01-2012
Version : V2.1

The information in this manual is subject to change without notice. Any trademarks, trade names, service marks or service names owned or registered by any other company and used in this manual are property of the respective companies.

De Haardt Electronic Engineering BV
Marithaime 6
6662 WD Elst (GLD)
The Netherlands
Tel: 0481 353202
Fax: 0481 353603

All products are designed as *supplement* to make karting safer, but *cannot* replace safe track procedures. If equipment fails, the normal operating procedure must still be adequate to safely operate the track.

This guide has been written with great care. However, the manufacturer cannot be held responsible, either for any errors occurring in this publication or for their consequences.

1   Index

2   Safety summary

To ensure thorough understanding of all functions and to ensure efficient use of the system, please read this manual carefully before using.

Please observe the following basics to prevent fire, burn, electric shock, and personal injury:

- Electrical and mechanical installation and servicing is only allowed by qualified personnel.

- Be sure to plug mains powered equipment in an electrical outlet which has a safety ground terminal.

- Never use the equipment with the case open.

- Service and repairs are only allowed by qualified technical engineers.

- Be sure to use fuses rated to the voltage in question.

- Connect the EV-Shutdown transponders only to a correctly fused power circuit. Be sure the power circuit is disconnected during installation and/or maintenance.

- Be protected against runaways, high current arcs and outgassing (from lead acid batteries) when working on electric vehicles.

3   Introduction

This document describes the standard operation and installation of the Xtra.Remote Kart and track control system.

The different parts of a standard Xtra.Remote Kart and Track Control system are:

- Xtra.Remote Control Unit
- Xtra.EV-Shutdown Transponder
- Xtra.Sector Beacon
- Xtra.Sector Sensor
- Xtra.Range Extender / Access point
- Xtra.Light Control Board
  (Start/Stop warning & race)

If you are not using all parts of our Xtra.Remote kart and track control system, then you can skip the chapters concerning those parts.

4   Installation

4.1   Xtra.Remote Control Unit

The following accessories are related to the Remote Control Unit:

- Remote Control Unit
- Adapter
- Serial cable
- Pair of rechargeable batteries
- Carriage bag / Industrial Cover
- Programming cable

4.1.1 Placing the batteries

The Xtra.Remote Control Unit can be equipped with 2 rechargeable NiMH batteries type AA. To place these batteries, open the battery cover. Pull the 'lock' spring towards the inside. Place the batteries according to the symbols + and – labeled in the battery compartment. Close the battery compartment by sliding the spring to the right and close the cover.

Important:

- Use only rechargeable batteries of the type NiMH, and no conventional batteries.
- Do not use old and new batteries together, or batteries from different manufacturers.
- Batteries contain chemical substances. Treat old batteries as chemical waste and don't leave them in the vicinity of children.
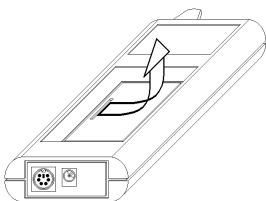
1. Open battery cover   2. 'Unlock' the spring
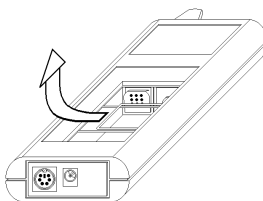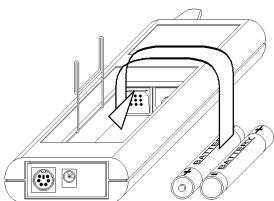
3. Place the batteries in the battery compartment
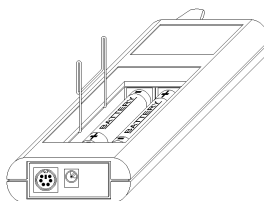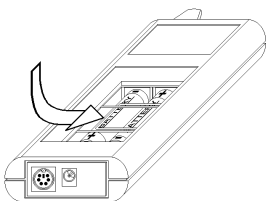
4. close the spring   5. Close the cover

The rechargeable batteries must be charged before use.

8

4.1.2 Connecting the adapter

Connect the provided adapter to the DC power connector of the Xtra.Remote Control unit and plug the adapter into the mains power supply socket.
Connecting the adapter to the Remote Control allows it to be used without batteries. The adapter can also be used to charge the NiMH batteries in the Xtra.Remote Control.
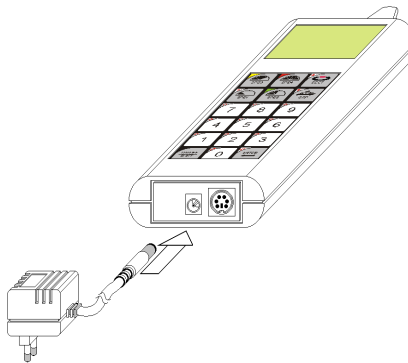
4.1.3 Connecting the antenna

The antenna of the Xtra.Remote Control can be fastened on the top side connector by turning clockwise. Do not apply excessive force as this could cause damage!

Caution: Do never use the antenna as a handle. Do not lift the Xtra.Remote control out of the carriage bag by its antenna.

4.1.4 Connecting to a Personal Computer

The Xtra.Remote Control can be connected to a PC by means of a serial cable.
This serial link gives third parties the ability to control and monitor the karts and track by means of a PC.
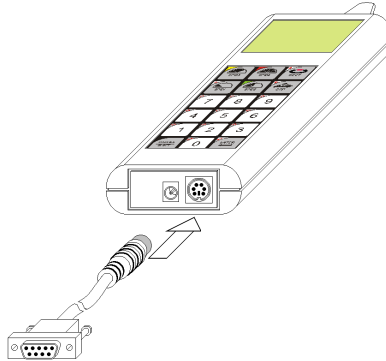
4.2 Xtra.EV-Shutdown Transponder

To be able to limit the speed of the karts from a distance, every kart must be equipped with an Xtra.EV-Shutdown Transponder. Each Xtra.EV-Shutdown Transponder has a unique serial number, and by using the Xtra.Remote Control it is possible for the user to give every Xtra.EV-Shutdown Transponder a kart number, a group number and/or track number.

Assigning a track number to the Xtra.EV-Shutdown Transponder gives the possibility, when other kart circuits are close by, to control the karts independently of each other. A maximum of 4 tracks can be assigned.

This gives for example the possibility to assign a kart number 1 on every circuit, and only a Remote Control which is also assigned to the same track will have control over this kart.

On the Xtra.EV-Shutdown Transponder there is also a plug for a network connection. By means of this network connection (future) applications or devices can be linked, and communicate with the Xtra.EV-Shutdown Transponder.

4.2.1 Assembly of the Xtra.EV-Shutdown Transponder

The Xtra.EV-Shutdown Transponder is easy to install on the kart, by means of its V-shape based housing. It is possible to mount the housing both on round and/or square tubes.
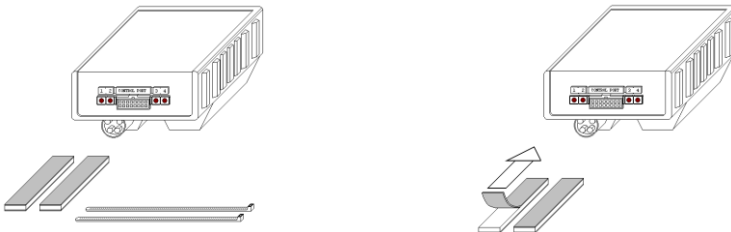
By means of 2 tie wraps and 2 double sided adhesive strips it is possible to mount the Xtra.EV-Shutdown Transponder in most cases.
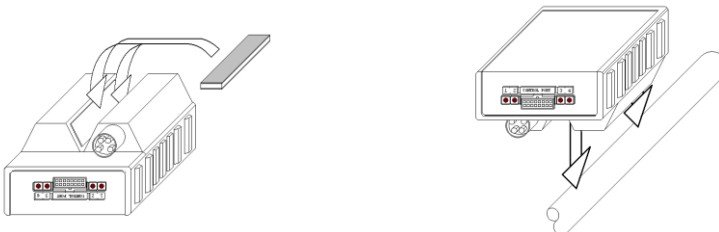
Place each of the double sided adhesive strips on one of the slanting V sides on the bottom part of the Xtra.EV-Shutdown Transponder.

Next, place the Xtra.EV-Shutdown Transponder on a frame tube of the kart, so that the adhesive strips keep the Xtra.EV-Shutdown Transponder in place.
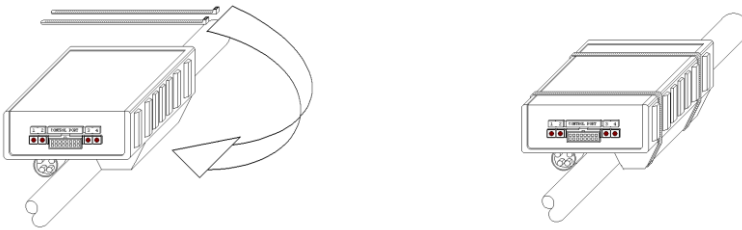

Fasten the Xtra.EV-Shutdown Transponder with 2 tie wraps, and ensure that these cannot tremble off during the use of the kart or by other causes.

Warning: The best way of mounting the transponder to your kart depends heavily on your kart's framework. Therefore the mounting instructions mentioned above should be considered as guidelines only. Because the transponder operates in a rough environment, every now and then a routine check-up must be made to ensure that the transponder is still properly fastened and shows no visual damage.

Keep the upper part (flat part) of the Xtra.EV-Shutdown Transponder away from any metal parts or wires and never place it facedown towards the track concrete.

Mount the Xtra.EV-Shutdown Transponder as far away as possible from wires which are conducting high currents.

There is no kart number printed on the Xtra.EV-Shutdown Transponder, only a serial number. Assigning a kart number, a group number and a track number to the Xtra.EV-Shutdown Transponder is explained in chapter 5.2.8 Menu->Shutdown tp->Assign on page 39.

Assigning the numbers is only possible when the Xtra.EV-Shutdown Transponder is powered.

When a new Xtra.EV-Shutdown Transponder is bought, the default kart number is factory set to the last 2 digits of the serial number.

Warning: *To prevent personal injury during installation of the Xtra.EV-Shutdown Transponder(s), the power circuit on the kart must be disconnected.*

Warning: *Make sure that the Xtra.EV-Shutdown Transponder is not damaged before using the kart. In case of an accident or when the driver steps out of the kart please validate correct functioning of the Xtra.EV-Shutdown Transponder.*

4.2.2. Electrical connection of the Xtra.EV-Shutdown Transponder

 The wiring of the Xtra.EV-Shutdown Transponder depends on the motor drive system used on the kart and on customers' demands.

Operating principle:
The Xtra.EV-Shutdown Transponders have internally 4 relays.

de Haardt
ELECTRONIC ENGINEERING

Depending on the selected speed button on the Xtra.Remote Control, certain relays will activate and others will deactivate (defined by the user configurable switching table).

The switch contacts of the relays are available on the CONTROL PORT. The switch contacts of the relays are also connected to the control port through a series resistor.

These 4 relay switches and/or resistors can be used to control the electric motor drive system on the kart, to create different speed levels.
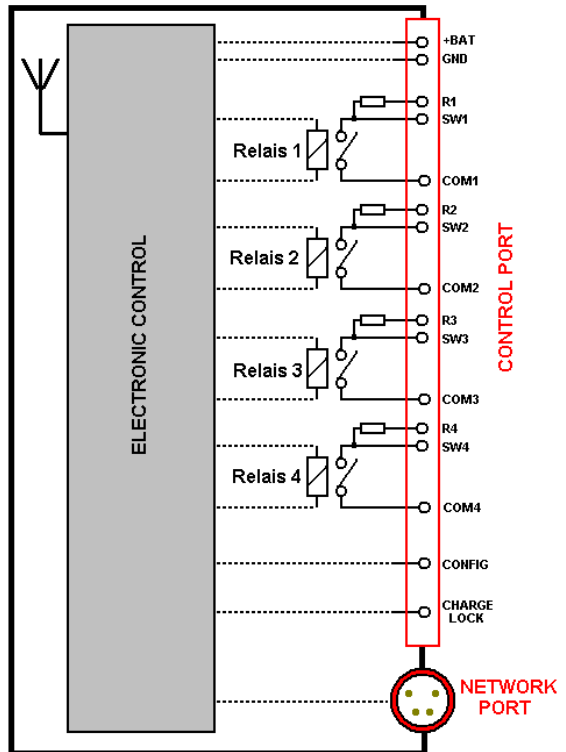
In the appendix example wire diagrams are given for some popular motor drive systems.

Operating modes:
Apart from the SPEED1, SPEED2, SPEED3, SPEED4 and STOP modes, the following modes are configurable too:

- **PowerUp:**
  o This state is entered when the Xtra.EV-Shutdown Transponder is powered up.

- **Charge Lock:**
  - o This state is entered when the ChargeLock pin on the CONTROL PORT is powered, indicating that the batteries are currently charging. In this state the Xtra.EV-Shutdown Transponder does not respond to any SPEED commands.

- **Charge Unlock:**
  - o This state is entered after the power has been removed from the ChargeLock pin on the CONTROL PORT.

POWER FUSE

CHARGE LOCK

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

+

-

BATTERY
CHARGER
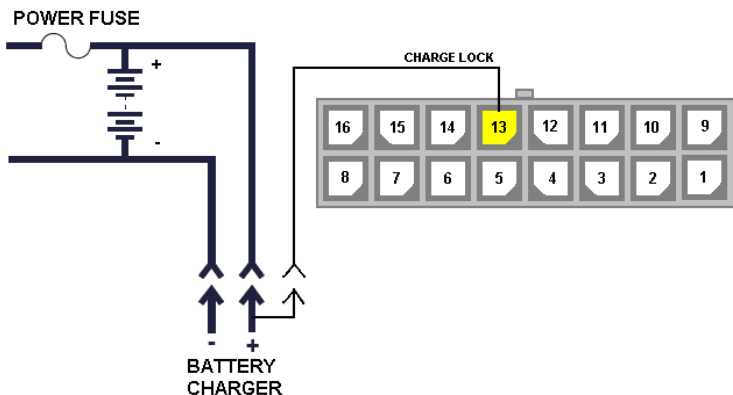
Programming the switching table:

With the Xtra.Remote Control, a user defined switching table can be uploaded to the Xtra.EV-Shutdown Transponder.

JUMPER WIRE TO ENABLE
UPLOAD SWITCHING
TABLE

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

During the upload, the CONFIG pin on the CONTROL PORT must be powered. This can be done by placing the programming cable in between the CONTROL PORT and existing wire harnass.
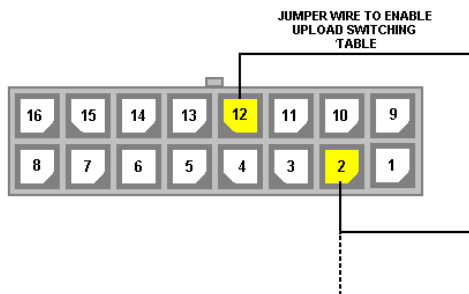
Network Port:

The Xtra.EV-Shutdown Transponder is fitted with a network port. Through this network port the Xtra.EV-Shutdown Transponder can be connected to other on-kart electronics.

Warning: *Always put the protection cap on the Xtra.EV-Shutdown Transponder's network port when this port is not used! Be sure that the protection cap is fully covering all outside metal parts of the network port connector.*
It is not allowed to connect devices to this network port which are not approved by De Haardt!
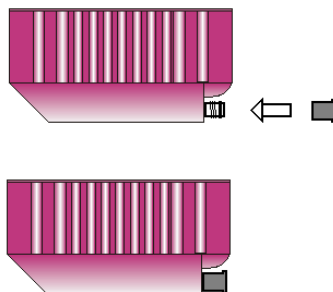
Safety warning:
Incorrect wiring and/or configuration of the Xtra.EV-Shutdown transponder and/or motor controller, may cause the vehicle to run out of control!
Check wiring regularly and repair damaged (broken, loose or shorted) wires immediately!

4.3 Xtra.Range Extender/Access point

The Xtra.Range Extender/Access point has a "relay" or "repeater" approach which helps to cover large and hard-to-reach areas and reflective corners on the race circuit.
The unit can also be used as an access point in case it is connected to the serial port of an external device. This gives for example third parties the ability to control and monitor the track and karts by means of a PC.

4.3.1 Mounting of the Xtra.Range Extender/Access point

The operating range of the Xtra.Range Extender/Access point depends on the height of the antenna above the ground, line of sight, and obstructions in the line of sight.

Therefore we suggest for range extension on outdoor circuits to mount the Xtra.Range Extender/Access point on a mast of at least 4 meters high or on one of the track light poles.

Locate the mast(s) on (a) strategic position(s), in the centre of the operating areas where obstacles (like trees and buildings) in the line of sight are at a minimum.
If you are mounting the antenna on a roof, it must be at least 1m above the roof line.

For indoor use the Xtra.Range Extender/Access point can be mounted for example on a fixture which is located on a building wall or on a pole. The fixture must provide a distance of at least 35cm between the Xtra.Range Extender/Access point and the wall.

Always position the Xtra.Range Extender in such a way that the antenna is in vertically position and pointed to the sky.

Guideline for mounting the Xtra.Range Extender/Access point on a pole (for illustration only):

Lift the plastic design covers of the Xtra.Range Extender/Access point from the aluminium housing.

Manual Xtra.Remote Electric
 Kart & Track Control System

de Haardt
ELECTRONIC ENGINEERING
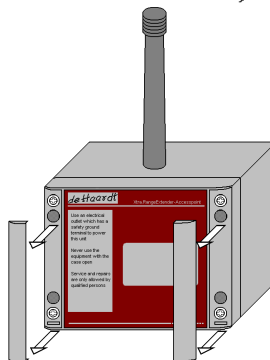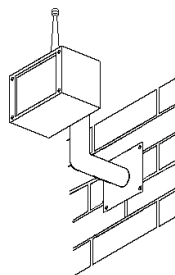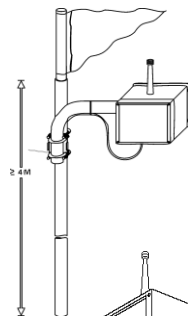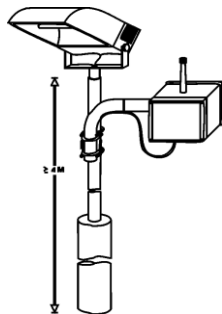
The 4 fastening holes are now visible. <u>Note</u>: It is not necessary to open the housing for mounting the unit!

Mount a baseplate to the support tube. This can be done by a bridge support. Use self locking nuts to prevent from loosening by vibration.
A rubber sheet of around 5mm thickness can be used to prevent the baseplate from bending in case of tight tolerances between the tube diameter and bridge support.

Fasten the Xtra.Range Extender/Access point on a baseplate with 4 screws (6mm diameter) and self locking nuts. Use spacers of around 10mm length between the Xtra.Range Extender and baseplate.

After mounting the Xtra.Range Extender on the baseplate, put the plastic design covers back in place.
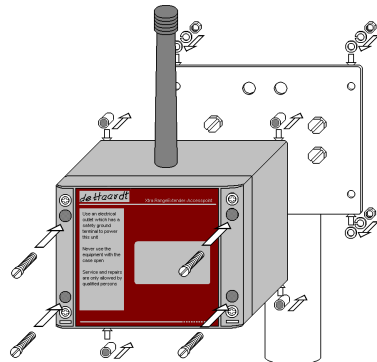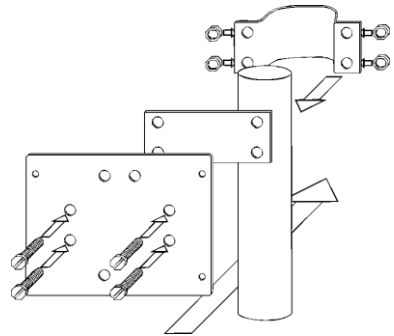
In case the support tube must be fastened to a pole, U-bolts in combination with a bridge support and self locking nuts can be used.

18
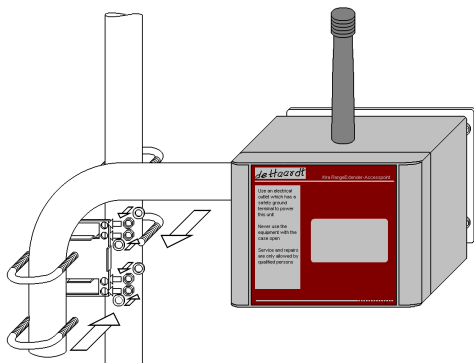
4.3.2 Electrical connections of the Xtra.Range Extender/Access point

The Xtra.Range Extender can be powered by:
- 230 Volt AC mains power supply
- 12 Volt DC supply, like a battery, solar panel or external dc supply.
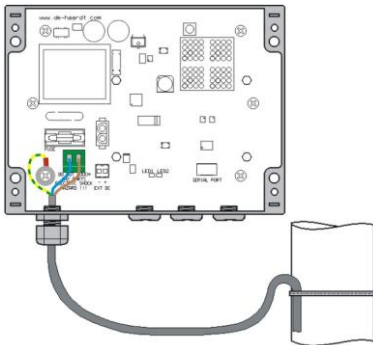
Standard the Xtra.Range Extender is supplied with a 230V mains power cord.

In case the unit must be powered by a 12 Volt DC supply, the main power cord has to be removed.

1. First disconnect the main power cord from the mains.
2. Open the Xtra.Range Extender/Access box, by loosening the 4 screws on the top.
3. Disconnect the green top connector of the power cord from the circuit board connector.
4. Loosen the 2 screws on the green connector on the cable.
5. Cut the Yellow-Green earth wire from the ring connector. Remove the remaining ring terminal out of the equipment housing. After removing the ring terminal fasten the circuit board again.
6. Loosen the gland and the power cord cable can be removed from the Xtra.Range Extender/Access point.

Once the power cord is removed, the 12 Volt supply cable can be inserted through the gland.

Connect the 12V cable to the 'EXT DC' connector on the circuit board. When the antenna is facing upwards, the left pin of the 'EXT DC' connector is the '-' (minus), and the right pin is the '+'.'
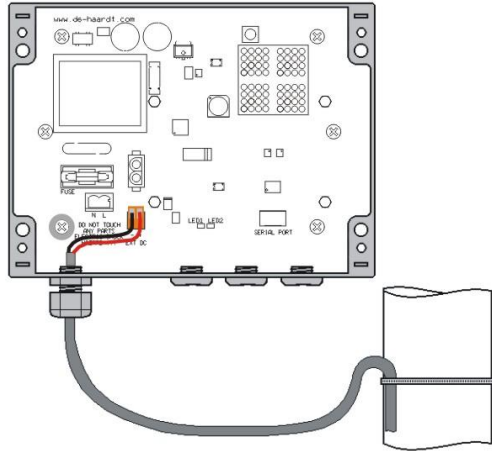
Important :

In case of powering the Xtra.Range Extender / Access point by way of an external DC power source, the Xtra.Range Extender DC supply cable must be fused externally (500mA).

de Haardt

ELECTRONIC ENGINEERING

www.de-haardt.com

DO NOT TOUCH
ANY PARTS
ELECTRIC SHOCK
HAZARD !!!

LED1 LED2

SERIAL PORT

EXT DC

EXT 4.5 ... 15V

230Vac

FUSE 100mA-Slow
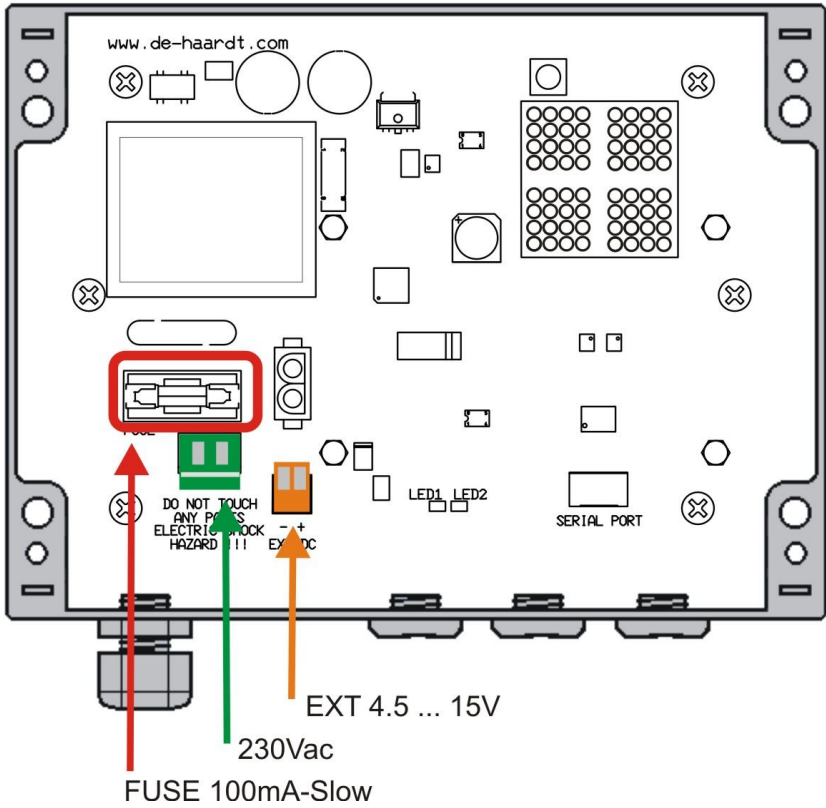
4.4   Xtra.(warning) Light Control Board

The Xtra.Range Extender/Access point can be extended with a Light Control Board. By way of this board three 230V switched outputs are created which for example can be used to turn on and off start, stop and (sector) warning lights.

In addition the light control has 4 low voltage inputs (12 Volt), which can be used to externally control the lights. Also by way of advanced system configuration (not described in this manual) other functions can be assigned to the 4 inputs.

The Light Control Board can only control the three 230V switched outputs when the Xtra.Range Extender / Access point is powered by 230 Volt. If the board is only used as input device then it can also operate when the Xtra.Range Extender is powered by the external DC input.

4.4.1 Mounting the Light Control Board

__Warning__: Disconnect all power sources from the Xtra.Range Extender / Access point and Light Control Board, when doing mounting and installation works!

The Light Control Board can be mounted on top of the Xtra.Range Extender / Access point board. On the Xtra.Range Extender / Access point are 4 spacers mounted, on which the Light Control Board has to be installed.
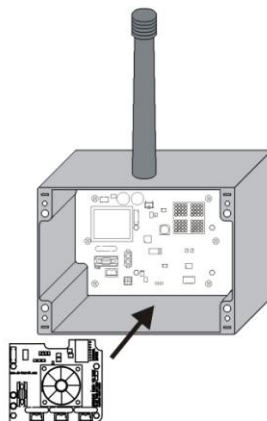
When positioning the Light Control
Board on the Xtra.Range extender
board, be sure that the pin header
on the Range Extender board is on
the same position as the connector
on the backside of the Light
Control Board.

Fixate the light controller board
with the 4 plastic screws.
Do not apply excessive force since
plastic screws are easily damaged.

After the Light Control Board is
mounted on top of the Xtra.Range
Extender / Access point board,
connect the input power connector
of the Light Control Board into the socket on the Range
Extender / Access point board.
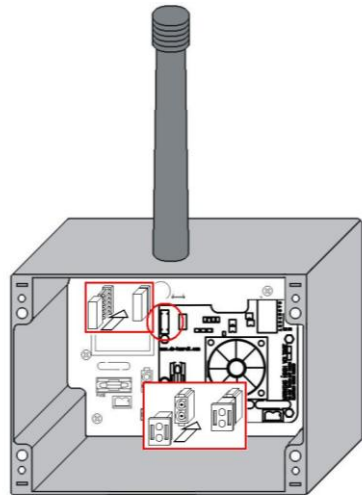
4.4.2 Wiring the Light Control Board

Once the Xtra.Light Control Board is installed, the
white power receptacle has to be connected to the
white power plug on the Xtra.Range Extender main
board. This connector is located next to the fuse.
The power connector has dual locking lances. Be
sure these are latched when the board is installed.

de Haardt
ELECTRONIC ENGINEERING
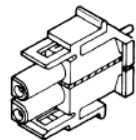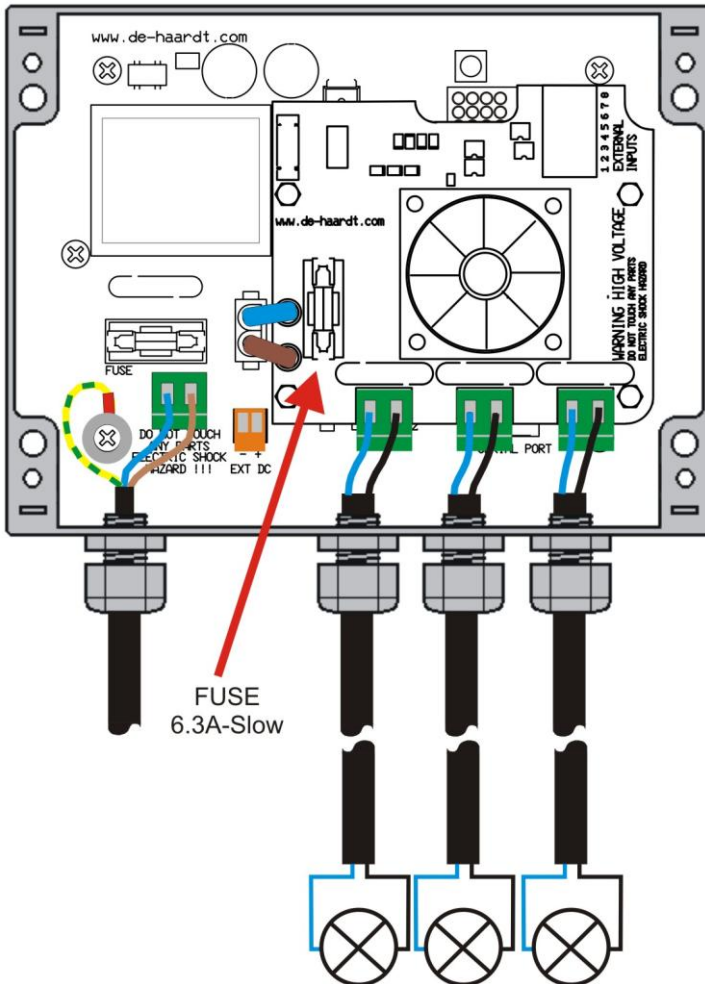
FUSE
6.3A-Slow

| Wire color	Explanation
Blue	Neutral
Brown	Live (Phase)
Black	Switched Live (Phase)
Yellow-Green	Earth

The Light Control Board is separately fused (6,3A/Slow). As illustrated above, there are individual connectors available on the Light Control Board for the 3 switched output channels.

Before starting the wiring, cable glands have to be screwed into the housing and securely fastened. Three M16x1.5 threaded holes are available for this purpose, which become visible after the blanking plugs are removed.

The M12x1.5mm threaded hole is available in case a cable must be connected to the control input of the Xtra.Light Control module.

The cable used to connect the switched output to the lights must at least be insulated and have a minimum of $1,0mm^2$ conducted area. The cable also has to be at least rated for 300/500V, with a maximum length of 50 meters.
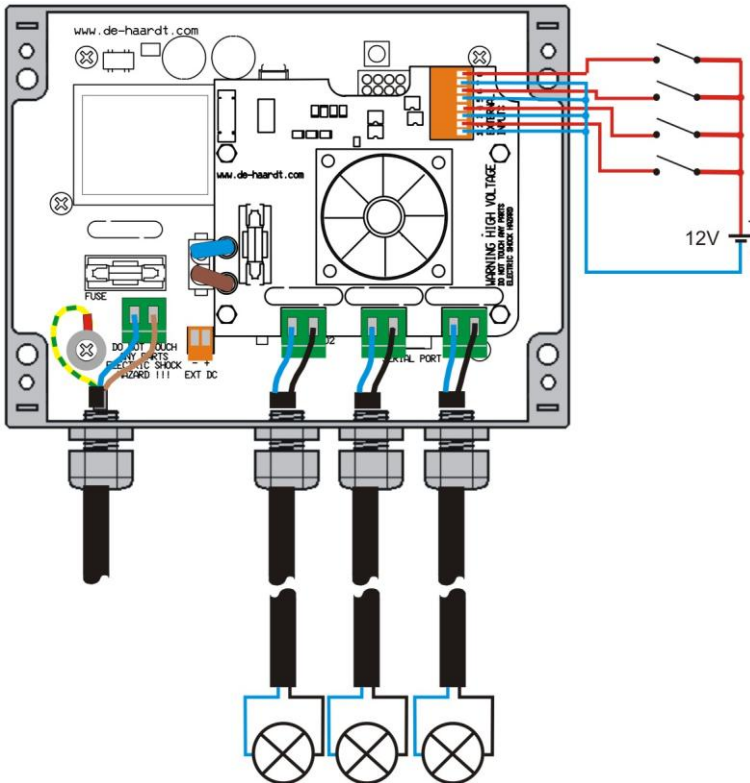
In the picture above there is given an example wiring for the 4 external control input signals. The table below describes the functions of the 8 pins of the external input connector.

External input pin	Description
1	(-) input 1 pin
2	(+) input 1 pin
3	(-) input 2 pin
4	(+) input 2 pin
5	(-) input 3 pin
6	(+) input 3 pin
7	(-) input 4 pin
8	(+) input 4 pin

Both external 12Vdc and 12Vac (50/60 Hz) input signals can be used for the input.

Use a multicore (Control) cable to connect the external inputs to the controlling device. This cable must have a voltage rating of at least 300 Volts, with a maximum length of 50 meters.

The controlling device must be isolated galvanically from the mains.

Important note:

All used cable glands must always provide fixation of the cable feed-trough up to a force of 60 Newton. Double check this time after time during maintenance.

The clamp range of the 3 M16 glands is 5.5–9mm. For the M12 gland this range is 4–6 mm. Never feed through cables with different diameters.

Prevent damage to the feed through cable caused by over fastening the dome nut on the gland body.

4.5 Xtra.Sector Control System

Using the Xtra.Sector Control System the speed of karts can be controlled in every section (zone) of the race track. In the case of an accident, the speed of the karts driving inside the dangerous zone is limited automatically. Once the karts are outside the dangerous section, the speed limit will be released.

The same system can be used for Pit-In and Pit-out speed control. Once a kart drives into the pit area, the speed is automatically reduced while the other karts on the track retain their normal speed. When a kart exits the pits, the speed is set to normal.

For circuits having 2 (or more) tracks which can be combined into one big track, the system can change the Track/Group settings of the Xtra.EV-Shutdown Transponder by simply driving a kart through the 'configuration sector'.

The Xtra.Sector Control System consists of one or more Xtra.Sector Beacon(s) placed along the track and Xtra.Sector Sensors mounted on every kart.

A wire is placed in a rectangular loop across the tarmac and attached to the Xtra.Sector Beacon. This loop marks the start of the sector. The loop/section number and function can be easily selected on the Xtra.Sector Beacon.

The Xtra.Sector Sensor is connected to the Xtra.EV-Shutdown transponder by means of the kart network port. Once the kart passes the loop, the intelligent Xtra.Sector Sensor processes the function received.

Track Sector numbering :

Every sector starts after passing the Xtra.Sector Beacon loop as illustrated below:
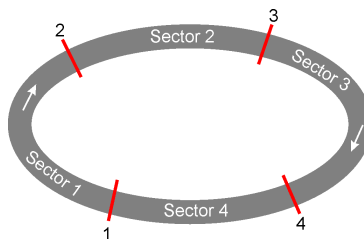
Sector numbering depends on driving direction as illustrated below:
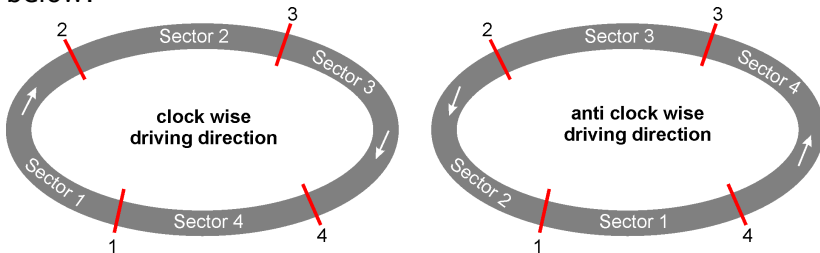
The Xtra.Sector Beacon can be configured for both driving directions, in case a separate "Driving Direction Unit" is used. As this unit normally is NOT supplied with the Xtra.Sector Beacon, this function is not further explained.

4.5.1 Electrical connection of the Xtra.Sector Beacon

The LOOP wire is placed in a rectangular groove which is cut in the race track surface.
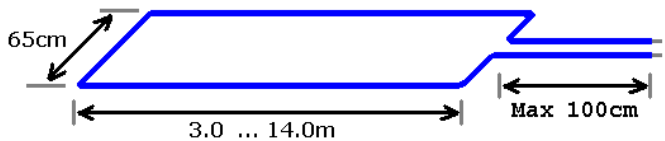
The 10mm deep by 3mm wide groove must ultimately be filled with silicon or another resin.
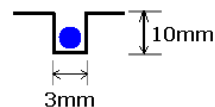
The ends of the LOOP wire must be attached (by soldering) to the 2 blue wires coming from the Xtra.Sector Beacon unit. Before soldering the loop wires, cut them to the required length and place the crimp sleeves.
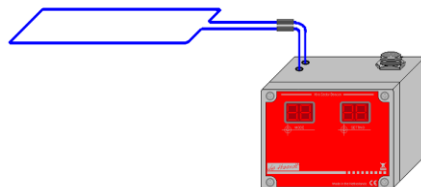
Once the soldering is

finished position the crimp sleeves over the solder
connections and crimp the sleeves with a heat gun.

The power for the
Xtra.Sector Beacon is
provided by an
external adapter.
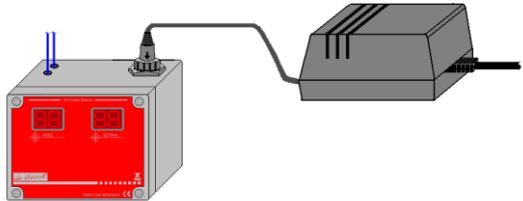
Push the adapter
power plug completely into the socket on the Xtra.Sector
Beacon. Once the plug is put correctly into the socket,
fasten the plug with its locking screw. Once locked, the
connection is water resistant.

Warning: *Keep unplugged connectors (both sockets and
plugs) completely dry and clean. Never expose them to
water, fuel, oil, chemicals or any kind of dirt!*

Warning: *The adapter itself is NOT waterproof and not
intended for outside use. In case the Xtra.Sector Beacon
system must be used outside, the adapter needs additional
protection.*
*The Xtra.Sector Beacon itself is 100% waterproof once the
power plug is connected conform instructions.*

4.5.2 Mounting of the Xtra.Sector Sensor

Every kart requires its own Xtra.Sector Sensor.

It is essential that the Xtra.Sector Sensor is
installed according to the descriptions below,
otherwise performance problems or even
damage can be expected.

The most important rules of installation are:

- The maximum distance between the loop antenna and the housing of the Xtra.Sector Sensor is 20 cm.
- For best performance the Xtra.Sector Sensor must be mounted flat on the karts plastic floor plate in line with the driving direction (printed arrow points to the driving direction). Aluminum floor plates may reduce performance.
- Keep the Xtra.Sector Sensor as far as possible away from tubes, iron or other electric conducting materials and the karts high current conducting cables.

It is advisable to first connect the Xtra.Sector Sensor to one kart only, then test if it performs properly, and continue to mount the timing transponders to all other karts.

The fixation of the Xtra.Sector Sensor can be done with 3 screws.

4.5.3 Electrical connection Xtra.Sector Sensor

On the kart, the Xtra.Sector Sensor must be connected to the Xtra.EV-Shutdown Transponder through the network port.

The network port is protected with a rubber cap normally. This rubber cap has to be removed before the network connector can be attached. Check the polarisation before fitting the connector!

Once attached double check the coupled connectors and make 100% sure that vibration cannot loosen the connection.

Warning*: Keep unplugged connectors (both sockets and plugs) completely dry and clean. Never expose them to water, fuel, oil, chemicals or any kind of dirt!*

Warning*: Make 100% sure that vibration can NOT loosen the network connection as this can cause several problems like bad functioning of the system, corrosion of the network plug and socket, etc..*

5   Operating the equipment

5.1   Button functions and basic operation of the Xtra.Remote Control

5.1.1 Switching the Remote Control On/Off
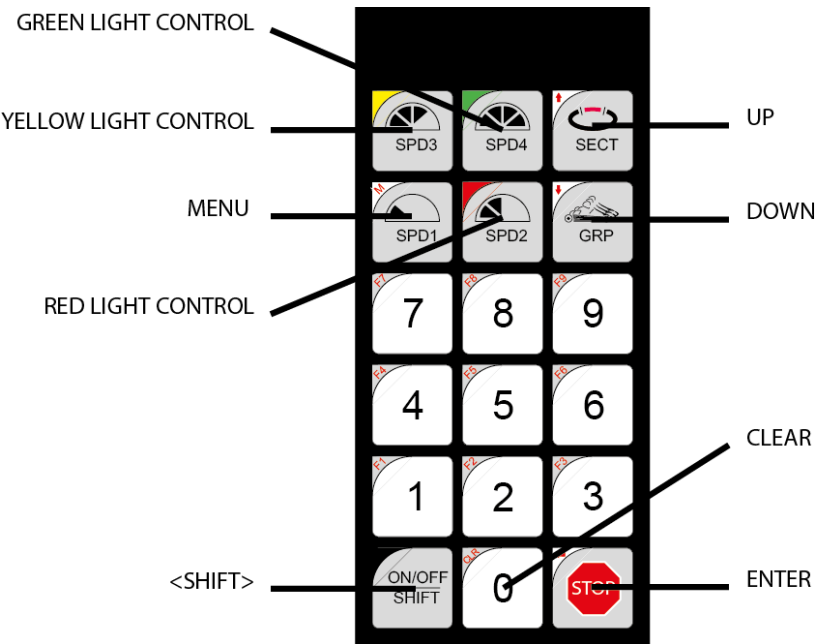
Press the **ON/OFF** button on the keyboard of the Xtra.Remote Control for at least one second to turn the device on. Once on, you can do the same to turn it off.

5.1.2 Indirect stop of all karts at once

By pressing the **SHIFT** button followed by the **STOP** button, all karts can be stopped at once.
If required, the remote can be programmed in such a way that this function can be executed by pressing the **STOP** button only.
Please follow the instructions at paragraph 5.2.7

5.1.3 Adjusting the speed of kart(s)

On the remote control there are 4 buttons for reducing the speed of the kart(s). These buttons are: **SPD1, SPD2, SPD3, SPD4**. Button **SPD1** (Speed 1) is meant for the lowest speed, and **SPD4** (Speed 4) for the highest speed.

5.1.4 Adjusting the speed of an individual kart

The speed of individual karts can be adjusted in 2 ways:

1. By entering the serial number of the Xtra.EV-Shutdown Transponder mounted on the kart concerned, followed by pressing one of the SPD buttons.
2. By entering the kart number (with the custom assigned kart number by means of *Menu->EV-Shutdown tp->Assign)*, followed by pressing one of the SPD buttons.

Serial numbers range from 65536 to 1048575.
Kart numbers range from 1 to 245.

5.1.5 Adjusting the speed of a group of karts

Before this function can be used, the user must assign (one time only) group number(s) to the Xtra.EV-Shutdown Transponder first. This can be done with "*Menu->EV-Shutdown tp->Assign*".

The speed of a group of karts can be adjusted by pressing the group number followed by pressing **GRP** and **SPD**.

Group numbers range from 1 to 5.

5.1.6 Adjusting the speed of all karts at once

Press one of the **SPD** buttons without a preceding number.

5.1.7 Adjusting the speed in multiple sectors

To be able to use this possibility, the kart must be fitted with a sector sensor which is connected to the Xtra.EV-Shutdown Transponder through the network. Also the track has to be subdivided into sectors using the Sector Beacon System.

To adjust the kart speed in a sector, press the sector number followed by the **SECT** button, and finally the **SPD** button.

To adjust the speed in several succeeding sectors, press the first sector number followed by the **SECT** button. Then press the last sector number followed by the **SECT** button and finally press the **SPD** button.

If a kart number is entered before pressing the **SPD** button, then the speed of only that individual kart will be adjusted when driving inside the entered sectors.

It is also possible to adjust the speed of a certain group of karts in one or more sectors. In this case enter the group number followed by the **GRP** button before the **SPD** button is pressed.

5.1.8 Penalties

Penalties (speed limitation for a short time) can be given to an individual kart, a group of karts or all karts.

In case the **0** button is pressed first, followed by pressing the regular speed reduction buttons, the penalty function is selected. As soon as the last button is pressed, the display indicates **(P)** to indicate the penalty.

Refer to 'Menu->Remote->Penalty Time' to setup the penalty time.

5.1.9 Adjusting the speed in steps

The speed of the karts can be increased/decreased step wise. To increase the speed with a step, press the **SHIFT** button, followed by the **UP** button.

To reduce the speed with a step, press the **SHIFT** button followed by the **DOWN** button.

The karts to which the command applies are taken over from the last entered speed command.

5.1.10 Repeating last command

To repeat the last speed command, press de upper right button **SECT**.

5.1.11 Operating (race) lights

Default the Xtra.Remote control can operate the Red, Yellow and Green (race) lights.

To operate the Red lights   press: **SHIFT SPD2**
To operate the Yellow lights   press: **SHIFT SPD3**
To operate the Green lights   press: **SHIFT SPD4**

The selected light menu appears, and by pressing `1`, `2` or `3` you can turn On, Off or toggle the light

5.2 Menu functions

By pressing the `SHIFT` button followed by the **`MENU`** button, the MAIN MENU of the Xtra.Remote Control appears.

With the **`UP`** and **`DOWN`** button it is possible to scroll through the menu. With the **`ENTER`** button an item can be selected.

By pressing the **`SHIFT`** and **`CLR`** button you can leave the menu at all time.

In the MAIN MENU, all the components of the Xtra.Remote kart and track Control system which can be configured by means of the Xtra.Remote Control, are displayed.

5.2.1 Menu->Remote->Track

By means of this menu the circuits (TRACKS) can be turned On or Off to which this remote control is part of.
The circuits are indicated with the characters A, B, C and D.

With the **`UP`** and **`DOWN`** button you can scroll through the menu and with the **`ENTER`** button the circuit can be turned On or Off.

It is possible to use the remote control on several circuits simultaneously.

5.2.2 Menu->Remote->Brightness

The brightness of the display can be adjusted by selecting this item from the menu.

5.2.3 Menu->Remote->Backlight

The backlight of the remote is normally disabled. By means of this menu this can be turned on.

Since the backlight of the LCD consumes relatively much energy, for mobile use (battery operated) it is advised to turn off the backlight.

5.2.4 Menu->Remote->Power Save

The Xtra.Remote Control is able to shut itself down when in idle state for a certain time. In this menu you can configure the time before the Xtra.Remote Control turns itself off.

5.2.5 Menu->Remote->Penalty Time

One of the 4 displayed penalty times can be chosen in this menu.

With the **UP** and **DOWN** button you can scroll through the menu and with the **ENTER** button one of the penalty times can be selected.

5.2.6 Menu->Remote->Power Info

In this menu the total battery voltage and the internal adapter voltage can be examined.

5.2.7 Menu->Remote->Direct stop

In this menu you can choose to operate the Direct Stop function by just pressing the **STOP** button only.

With the **UP** and **DOWN** button you can scroll through the menu and with the **ENTER** button the direct stop function can be turned On or Off.

If turned On, the Direct stop function is activated.

If turned Off, the Indirect stop function as described in
paragraph 5.1.2 is activated.

5.2.8 Menu->Shutdown tp->Assign

In this menu you can assign a kart number, a group
number(s) and different tracks to the Xtra.EV-Shutdown
Transponder.

After entering the serial number of the Xtra.EV-Shutdown
Transponder, all the current settings are loaded from the
Xtra.EV-Shutdown Transponder into the Remote Control and
shown on the display.

The loaded settings can now be modified by scrolling
through the listed items (**UP** and **DOWN** buttons).

1. Kart numbers are entered by pressing the numerical
    buttons, if you want to delete a number press **SPD3**
2. Group numbers are toggled by pressing the buttons
    1 to 5 and the display shows the currently selected
    group numbers.
3. Circuits/Tracks are toggled by pressing the buttons
    1 to 4 (1 is Track A, 2 is Track B…..). The display
    shows the currently selected tracks. At least 1
    track/circuit has to be selected.

Scroll to the **[NEXT]** item and press the **ENTER** button, to
upload the settings to the Xtra.EV-Shutdown Transponder.

5.2.9 Menu->Shutdown tp->Read timer

By entering the kart or serial number of the Xtra.EV-
Shutdown Transponder you can read out the running time
of that kart.

5.2.10 Menu-> Shutdown tp->Reset timer

By entering the kart number or the serial number of the Xtra.EV-Shutdown Transponder the running time counter can be reset to zero.

5.2.11 Menu->Shutdown tp->Battery Voltage

By entering the kart number or the serial number of the Xtra.EV-Shutdown Transponder you can read out the battery voltage of the addressed kart.

5.2.12 Menu->Shutdown tp->Switch Table

By entering the Switch Table menu you can download, upload, edit and store the relay switching table.

The settings can now be modified by scrolling through the listed items (**UP** and **DOWN** buttons).

There are 7 states for which the 4 relays can be configured:

1. State *STOP*
2. State *SPEED1*
3. State *SPEED2*
4. State *SPEED3*
5. State *SPEED4*
6. State *CHARGE LOCK*
7. State *CHARGE UNLOCK*

By scrolling to a state, relays can be toggled between on and off by pressing the buttons 1 to 4. The 4 displayed check boxes indicate which relays will be activated (box 1 for relay 1, box 2 for relay 2, etc.).

Once the relay settings are configured for all states, the switching table can be uploaded to the Xtra.EV-Shutdown transponder. Scroll to the **STORE TP** item on the screen and press **ENTER**.

40

ELECTRONIC ENGINEERING

> *Note:*
> *Please note that the Xtra.EV-Shutdown transponder will only store the switching table when the CONFIG pin on the CONTROL PORT is powered. (See chapter "Electrical connection of the Xtra.EV-Shutdown Transponder").*

By scrolling to `Store Mem` and pressing **ENTER**, the switching table is stored to the memory of the Xtra.Remote Control.

By scrolling to `Load Mem` and pressing **ENTER**, the switching table is loaded from the memory of the Xtra.Remote Control.

By scrolling to `Load tp` and pressing **ENTER**, the switching table is loaded from the memory of the Xtra.EV-Shutdown Transponder.

5.2.13 Menu->Range Extend->Track

After entering the serial number of one of your Range Extender / Accesspoints, a track list is shown. A marked track means that the Range Extender is listening to commands of that track. By selecting the desired track and pressing the **ENTER** button, the selection can be toggled.

In the 'Range Extension' field of the menu, the Range Extender function of the unit can be enabled/disabled.

To store the setting to the Range Extender, you have to set the marker to the Store field and press **ENTER**.

5.2.14 Menu->Range Extend->Link Check

To check if a Range Extender can 'see' another Range Extender, enter the serial number in the **To** and **From** fields and press **ENTER**.

The results are shown on the display.

5.3 Configuration of the Xtra.Sector Beacon

The Xtra.Sector Beacon can be configured by using the 'magnetic tip pen' on the front panel of the unit.
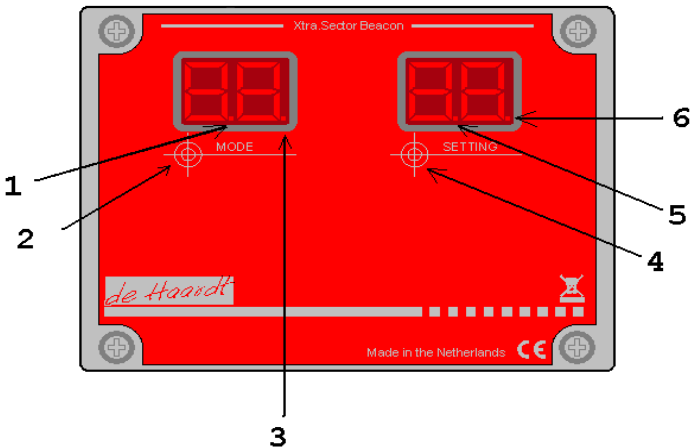
Number	Explanation
1	The DOT indicates that the internal MODE switch is activated by the 'magnetic tip pen'.
2	The CROSS indicates the position to put the 'magnetic tip pen' for changing MODE.
3	This DOT indicates the driving direction. When turned off, the default driving direction is selected. When turned on, the reverse driving direction is selected.
4	The CROSS indicates the position to put the 'magnetic tip pen' for changing SETTING.
5	The DOT indicates that the internal SETTING switch is activated by the 'magnetic tip pen'.
6	This DOT indicates the driving direction. When turned off, the default driving direction is selected. When turned on, the reverse driving direction is selected.

Every time the 'magnetic tip pen' is held near the MODE cross (2), the next mode is shown on the left part of the display.

Meaning of the 2 displayed Mode characters is described in the table below.

Mode	Description
Sn	Sector number
Fn	Function number
Ad	Address
Er	Error number

After selecting a mode, keep the 'magnetic tip pen' near the SETTING cross (4) until the digits start blinking.

Once the SETTING digits are blinking, the value can be changed by holding the 'magnetic tip pen' near the SETTING cross (4).

The new value can be stored by keeping the 'magnetic tip pen' for more than 1 second at the MODE cross (2).

5.3.1 Mode -> Sector number

Every Xtra.Sector Beacon loop can be used to mark the start of a new sector on the track. Sector numbers range from 0 - 31.

In case sector number 0 is selected, the Xtra.Sector Beacon is put in standby mode. The result is that the Xtra.Sector Sensor will ignore all Xtra.Sector Beacon commands. Only the Led indicator on top of the Xtra.Sector Sensor flashes for diagnostic purposes.

5.3.2 Mode -> Function number

A function can be assigned to every Xtra.Sector Beacon loop. Functions are numbered and range from 0 - 63. The table below describes valid functions.

Function number	Details
0	No function, default value for Sector Speed Control
Charge locking of the Xtra.EV-Shutdown Transponder	
2	Charge Lock Xtra.EV-Shutdown Transponder
3	Charge UnLock Xtra.EV-Shutdown Transponder
Limit the speed of the kart when passing the beacon LOOP:	
10	STOP the kart when passing the Xtra.Sector Beacon LOOP.
11	LIMIT kart speed to SPEED1 level (Advised for PIT-IN)
12	LIMIT kart speed to SPEED2 level when passing the beacon LOOP.
13	LIMIT kart speed to SPEED3 level when passing the beacon LOOP.
14	LIMIT kart speed to SPEED4 level when passing the beacon LOOP. (Advised for PIT-OUT)
Configuration functions for the Xtra.EV-Shutdown Transponder:	
20	Configure Xtra.EV-Shutdown Transponder for Group number 1.
21	Configure Xtra.EV-Shutdown Transponder for Group number 2.
22	Configure Xtra.EV-Shutdown Transponder for Group number 3.
23	Configure Xtra.EV-Shutdown Transponder for Group number 4.
24	Configure Xtra.EV-Shutdown Transponder for Group number 5.
25	Configure Xtra.EV-Shutdown Transponder for Track A
26	Configure Xtra.EV-Shutdown Transponder for Track B

| 27 | Configure Xtra.EV-Shutdown Transponder for Track C |
| 28 | Configure Xtra.EV-Shutdown Transponder for Track D |

Function numbers not mentioned above are reserved for future purposes.

5.3.3 Mode -> Address

The Xtra.Sector Beacon address ranges from 0 - 63 but is required only for special applications. Therefore this item is not further explained and the selected value is of no importance.

5.3.4 Mode -> Error

The Xtra.Sector Beacon tunes the loop at power-up. If the Xtra.Sector Beacon detects problems while tuning the loop, an error number is shown on the display. To reset an error, turn the unit off and on again.

Error number	Diagnostic result
0	No error
1	Loop not connected
2	Loop too long
3	Loop too short

5.4 Operating the Xtra.Sector Sensor

The LED indicator on top of the Xtra.Sector Sensor gives diagnostic information when passing an Xtra.Sector Beacon loop as shown in the table below.

Number of flashes	Diagnostic result
1	Bad reception or faulty data received
2	Reception acceptable
3	Reception good

6 WEEE Legislation

European Directive 2002/96/EC requires that the equipment bearing this symbol on the product and/or its packaging must not be disposed of with unsorted municipal waste. The symbol indicates that this product should be disposed of separately from regular household waste streams. It is your responsibility to dispose of this and other electric and electronic equipment via designated collection facilities appointed by the government or local authorities. Correct disposal and recycling will help prevent potential negative consequences to the environment and human health. For more detailed information about the disposal of your old equipment, please contact your local authorities, waste disposal service, or the shop where you purchased the product.

7   Declaration of Conformity

We, the undersigned,

Company:	De Haardt Electronic Engineering BV
Address:	Marithaime 6
	6662 WD, Elst (GLD)
Country:	The Netherlands

declare that the following equipment :

Xtra.EV-Shutdown Transponder
Xtra.Remote Control
Xtra.Range Extender / Access point
Xtra.Light Control Board

is in conformity with the following standards :

EN 300 220-3 V1.1.1 (September 2000)
EN 301 489-1 V1.4.1 & EN 301 489-3 V1.4.1 (August 2002)
IEC 60950-1:First edition 2001-10
EN 60950-1:2001, including amendment A11:2004

And therefore complies with Directive 89/336/EEC &
73/23/EEC of the European parliament.

Date:	25-10-2005
Drawn up in:	Elst (GLD), The Netherlands
Name:	J. de Haardt
Signature:	

8   Control Port specification
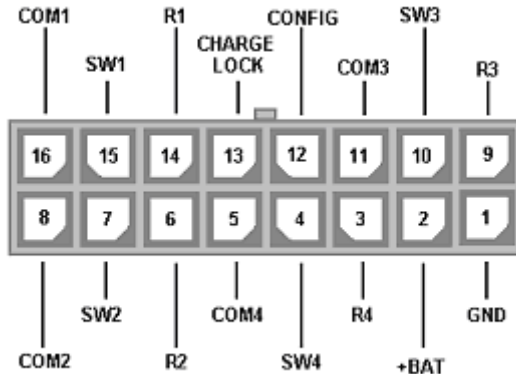
Xtra.EV Transponder connector type:
Molex, Micro-Fit 3.0, 16 Contacts, Gold in contact area.

Connector mating advice:
- Molex, Micro-Fit 3.0 Wire to Wire RECEPTACLE, Dual Row, SERIES 43025, 16 Positions.

- Molex, Micro-Fit 3.0 Crimp Terminal, Female, with 30u **Gold** (Au) Plated Tin/Brass Alloy Contact, 20/22/24 AWG

ELECTRONIC ENGINEERING
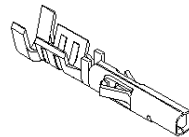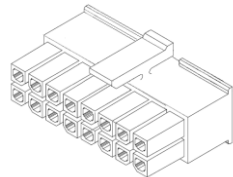
Pin Number	Name	Description
1	GND	Ground terminal
2	+BAT	Power supply input. Min input voltage: 10 Vdc Absolute max input voltage: 95Vdc
3	R4	Resistor 4 pin Resistance value: 5K6
4	SW4	Relay 4 Switch contact
5	COM4	Relay 4 Switch Common
6	R2	Resistor 2 pin Resistance value: 2K2
7	SW2	Relay 2 Switch contact
8	COM2	Relay 2 Switch Common
9	R3	Resistor 3 pin Resistance value: 20K
10	SW3	Relay 3 Switch contact
11	COM3	Relay 3 Switch Common
12	CONFIG	Logic input pin to enable uploading switch table.
13	CHARGE LOCK	Logic input pin to lock the Xtra.EV-Shutdown Transponder during battery charging
14	R1	Resistor 1 pin Resistance value: 1K2
15	SW1	Relay 1 Switch contact
16	COM1	Relay 1 Switch Common

General :
Maximum power dissipation of R1, R2, R3 & R4: 0.1 Watt
Maximum relay switch current: 0.1 Amp
Maximum relay switch voltage : 95 V

Logic input levels: >9 Volt High; <1 Volt Low
Logic input resistance: around 1Mohm.

9   Wiring examples

9.1   ASMO MD-95

The ASMO MD95 motor controller is a direct current motor controller. It controls motor current and, consequently, the torque produced.

In this example the motor controller is started/stopped with relay 1 from the Xtra.EV-Shutdown transponder, by paralleling the relay switch contact across the brake switch/speed pot.

By connecting a resistor (Xtra.EV-Shutdown transponder) between pin 6 of the MD95 controller and ground, the maximum battery current is limited, and indirectly also the maximum speed.

Switching table

State	Relay				Remark
	1	**2**	**3**	**4**	
PowerUp					After a power-up, the motor controller is enabled.
Stop	√				
Speed1					
Speed2			√		
Speed3				√	
Speed4		√			
Charge Lock	√				
Charge UnLock					After the charge plug is removed, the motor controller is enabled.
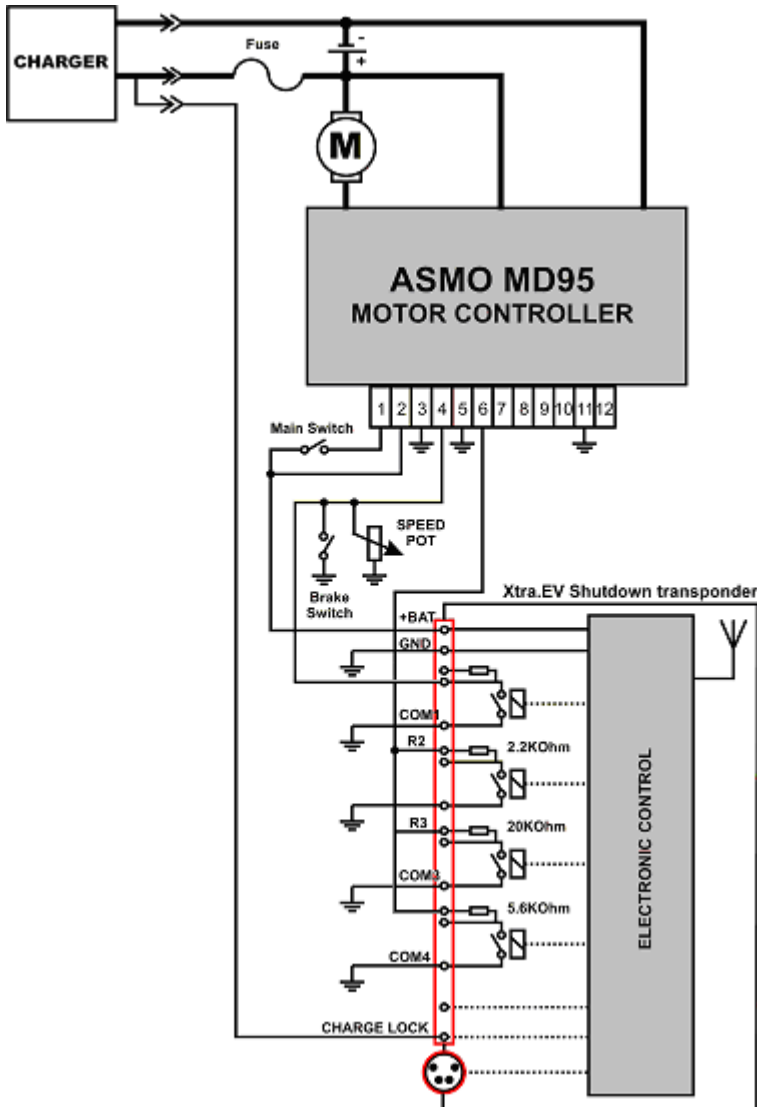
Warning: *Do NOT use pin 12 on the MD95 as a power source for the Xtra.EV-Shutdown transponder, as this can damage both the MD95 controller and Xtra.EV-Shutdown transponder.*

9.2   MillipaK 4QPM

The MillipaK 4QPM is a 4 quadrant permanent magnet motor
controller. This motor controller can be tested and
configured with the handheld 'Calibrator'.

For proper operation of the example wiring diagram, the
MillipaK controller must be correctly configured. The main
parameters are :
  • Configure Digital I/O value 7. (*Ride On vehicle with
    Speed Cutback 1 and 2 switches and external LED
    drive.*
  • Configure Cutback Speed 1
  • Configure Cutback Speed 2
  • Configure Maximum Speed (for example 100%)

In this wiring example the Xtra.EV-Shutdown transponder
relays are used to control some digital inputs from the
MillipaK motor controller.

Relay 1 : Digital Input 6 (Speed Cutback 2)
Relay 2 : Digital Input 5 (Speed Cutback 1)
Relay 3 : FS1
Relay 4 : Forward control

Switching table

State	Relay				Remark
	1	**2**	**3**	**4**	
PowerUp	√	√	√	√	After a power-up, the motor controller is enabled without speed reduction
Stop					
Speed1	√		√	√	Cutback Speed 1 configured to 30%
Speed2		√	√	√	Cutback Speed 2 configured to 65%
Speed3	√	√	√	√	Not available on Millipak 4QPM, therefore configured the same as speed 4.
Speed4	√	√	√	√	
Charge Lock					
Charge UnLock	√	√	√	√	After the charge plug is removed, the motor controller is enabled without speed reduction

de Haardt

ELECTRONIC ENGINEERING

CHARGER

MAIN FUSE

Contactor

-
+

Fuse

Key switch

M

B+   M+   M-   B-

MillipaK 4QPM
MOTOR CONTROLLER

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

SPEED POT

Xtra.EV Shutdown transponder

+BAT
GND
SW1
COM1
SW2
COM2
SW3
COM3
SW4
COM4

CHARGE LOCK

ELECTRONIC CONTROL

54
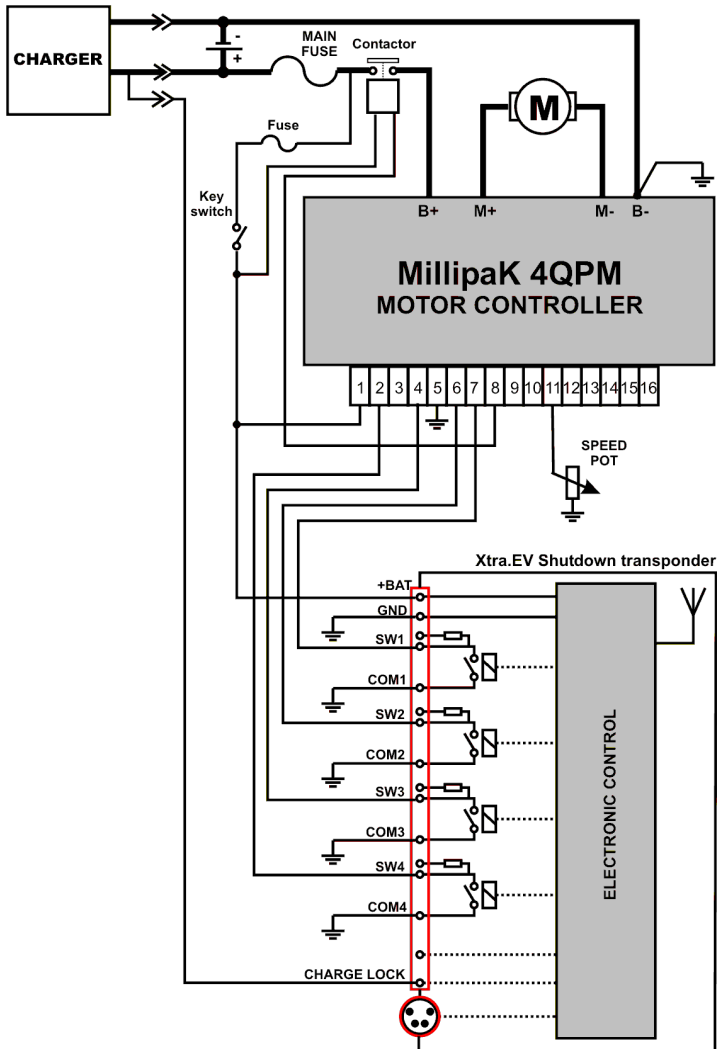
9.3   Curtis PMC 1244

Curtis PMC 1244 is a separately excited motor speed
controller. The controller is fully programmable by means of
the optional handheld programmer.

For proper operation of the example wiring diagram, the
Curtis controller must be correctly configured. The main
parameters are :
- Use of the Multimode must be enabled
- Configure Maximum Speed in mode 1
- Configure Maximum Speed in mode 2
- Configure Maximum Speed in mode 3
- Configure Maximum Speed in mode 4

In this wiring example the Xtra.EV-Shutdown transponder
relays are used to control the MODE SELECT 1 & 2 inputs of
the Curtis controller. Also the FORWARD INPUT is controlled
by the Xtra.EV-Shutdown transponder.

Relay 1 : not used
Relay 2 : FORWARD
Relay 3 : MODE SELECT 2
Relay 4 : MODE SELECT 1

Switching table

State	Relay				Remark
	1	**2**	**3**	**4**	
PowerUp					After a power-up, the motor controller is stopped.
Stop					
Speed1		√			Multimode 1 , (For example Mode 1 Maximum Speed configured to 25%)
Speed2		√		√	Multimode 2 (For example Mode 2 Maximum Speed configured to 50%)
Speed3		√	√		Multimode 3 (For example Mode 3 Maximum Speed configured to 75%)
Speed4		√	√	√	Multimode 4 (For example Mode 4 Maximum Speed configured to 100%)
Charge Lock					
Charge UnLock		√	√	√	After the charge plug is removed, the motor controller is enabled without speed reduction

CHARGER

POWER FUSE Contactor

CONTROL FUSE

M

B+   F2   F1   M-   B-

CURTIS PMC 1244
MOTOR CONTROLLER

Key switch

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

SPEED POT

INTERLOCK

THROTTLE SWITCH

Xtra.EV Shutdown transponder

+BAT
GND

SW2
COM2
SW3
COM3
SW4
COM4

CHARGE LOCK

ELECTRONIC CONTROL
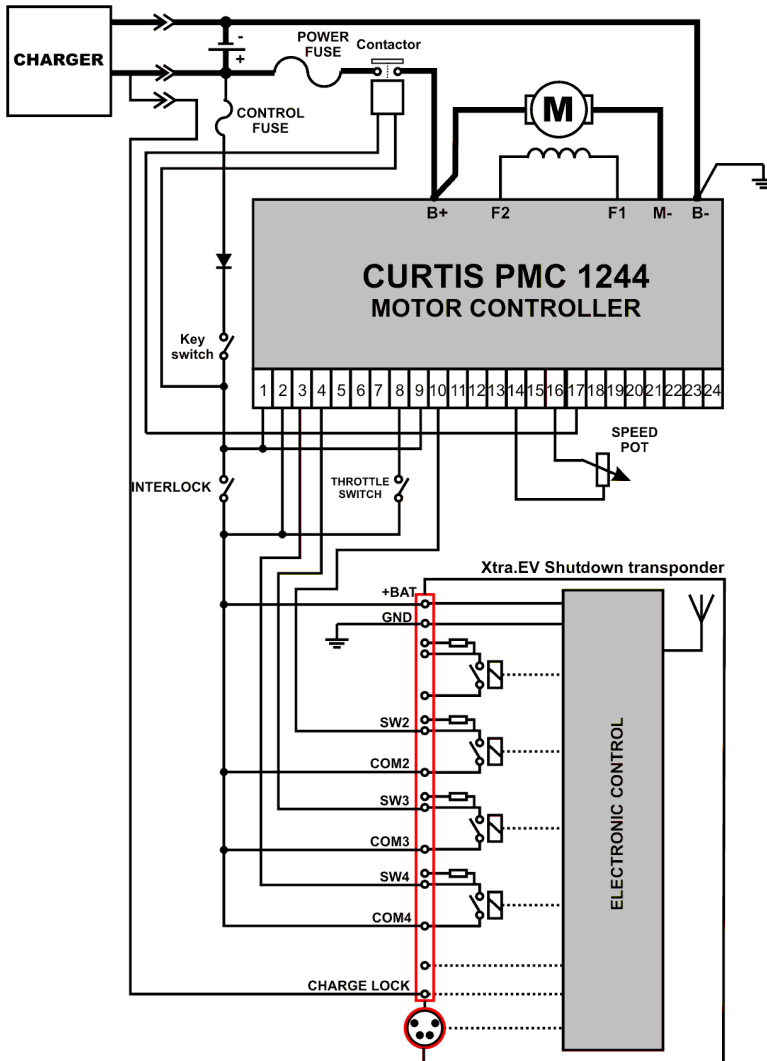
10 Technical specifications

10.1 Xtra.Remote Control

Dimensions	LxWxH = 172x77x25 mm (without antenna)
Maximum number of karts	Unlimited, 245 custom assignable (short) kart numbers
Keyboard	Membrane with tactile feedback
Display	Graphic LCD, with backlight
Radio technology	2 way communication
Battery standby time	96 hours
Battery operation time	16 hours
Charge time	16 hours
Buzzer	Integrated
Power supply	• Mains adapter • Batteries
Batteries	2 x High capacity Rechargeable Ni-MH, size AA, min 2100 mAh
Battery charger	Integrated
PC connection	RS-232 port
Humidity	Max 85% relative
Traffic , Race light Control	Yes
Speed select buttons	SPD1, SPD2, SPD3, SPD 4 and STOP
Number of tracks to be controlled	4
Brightness control	Yes, multiple levels
Backlight modes	10s, 30s, off
Power save	Automatic 30s, 1m, 5m, off
Diagnostics functions	Available
Stepwise speed control	Yes, by UP and DOWN buttons
Battery voltage meter	Available
Penalties	4 penalty times can be setup. Penalty speed limit can be selected out of the 4 speed limits
Software upgradable	Yes
Carriage bag	Available
Weight	Approx. 290 grams
Temperature Range	-10 to +55 Degrees Celsius

10.2 Xtra.EV-Shutdown Transponder
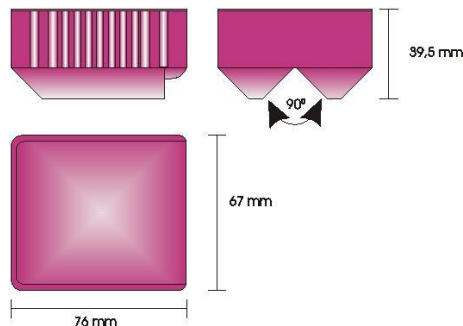
Dimensions	LxWxH = 76x67x39.5 mm
Antenna	Integrated
Maximum number of karts	Approx. 1.000.000 245 custom assignable (short) kart numbers
Maximum number of groups	5 custom assignable group numbers
Maximum number of tracks	4 custom selectable
Engine EV-Shutdown	Yes
Operating principle	Relays switch table
Operating voltage range	10 - 95 Volt
Radio technology	2 way communication
Network	By means of the network connection, (future) units on karts can mutually communicate
Battery voltage meter	Real time readable with the Xtra.Remote Control.
Motor controller type	Curtis, Zapi, Asmo, Gravitron and more.
Engine running time counter	Real time readable with the Xtra.remote control
Enclosure	Mountable on round and square tubes, supported with tie-wrap feeds
Weight	Approx. 200 grams
Temperature range	-10 to +55 Degrees Celsius

10.3 Xtra.Range Extender / Access point

Dimensions	LxWxH = 180x148x91 mm (without antenna)
Power supply	• 230 V AC (+10 … -15%) , 50-60 Hz • 4.5 - 15V DC(Outputs of the Light Control Board can **NOT** be used)
Radio technology	2 way
Enclosure	Die-cast IP65
Range extender	Enabled / disabled 4 tracks, can be individually enabled/disabled
Warning messages	Low battery detect warning
Access point interface	RS-232
Rated temperature range	-10 to +50 Degrees Celsius (without Light Control Board installed) -10 to +40 Degrees Celsius (with Light Control Board installed)
Maximum Current from mains	6.3 Amps, with Light Control Board is installed. 0.1 Amps, without Light Control Board installed
Maximum current external DC port.	250 mA.
Software upgradable	Yes
Weight	Approx. 1650 grams

ELECTRONIC ENGINEERING

10.4 Light Control Board

Outputs	3 channels (Mains switches)
Output light patterns	- Continuous on - Continuous off - Blinking on/off (Blinking time 20 to1000 mSec) Configurable for each output channel individually
Maximum total output current	6.3 Amp
Maximum individual output current	4 Amp
Inputs	4 galvanic isolated 12 volt inputs. Both ac and dc voltages can be used
Input trigger	- Rising edge - Falling edge - Positive level - Negative level
Fuse	6.3 A / Slow (20mm)
Power source	Internally from Xtra.Range Extender / Access point
Temperature range	-10 to + 40 Degrees Celsius
Weight	Approx. 100 gr

10.5 Xtra.Sector Beacon

Dimensions	LxWxT = 116x91x81 mm
Display type	LED
Functions	User selectable : • Sector Speed control • Limit SPEED to 2100 RPM • Limit SPEED to 3000 RPM • Limit SPEED to 4000 RPM • Limit SPEED to 0 RPM (STOP) • No SPEED limit • SET Xtra.EV-Shutdown transponder to Track A, B, C or D • SET Xtra.EV-Shutdown transponder to Group 1, 2, 3, 4 or 5
Maximum number of Sectors	31
Functions	User selectable using 'Magnetic Tip Pen'
Sector numbering	• Clock wise • Anti clock wise (Switchable using 'Driving Direction Unit')
Xtra.Sector Beacon Power supply	• 12V DC through 8p- MINI DIN waterproof connector • Mains adapter is supplied with system
Interface port	RS-485 through 8p- MINI DIN waterproof connector
Software upgradeable	Yes
Weight Xtra.Sector Beacon Weight adapter	Approx. 420 grams Approx. 875 grams
Temperature range	-10 to +55 Degrees Celsius

10.6 Xtra.Sector Sensor

Dimensions	LxWxT = 67/88x49x23 mm
Mounting direction	Horizontal, in line with driving direction
Max mounting height	20 cm *1
Cable length	Approx. 75 cm.
Indicator	LED
Enclosure	Screw mountable
Communication	By means of the kart network port
Power supply	Via (kart) network port
Power backup	Internal Lithium battery
Software upgradeable	Yes
Weight	Approx. 115 grams
Temperature range	-10 to +55 Degrees Celsius

*1 :   With no magnetic absorbing material between
       Xtra.Sector Sensor and the track loop.

11 Warranty

1. De Haardt Electronic Engineering BV guarantees for 12 months after delivery of the goods sold or provided for use that:
   - the goods can perform the tasks stated in the manuals, descriptions and documentation;

2. The liability under the guarantee contained in this article is limited at De Haardt Electronic Engineering BV's choice to remedying material and manufacturing faults free of charge in De Haardt Electronic Engineering BV's own workshop, supplying new parts free of charge and taking back and acquiring the ownership of the non-functioning parts, or applying a price reduction by agreement with the other party on the goods supplied or provided for use. De Haardt Electronic Engineering BV cannot under any circumstances be obliged to come to the location of the delivered goods to establish defects claimed by the other party. Equally, De Haardt Electronic Engineering BV cannot be compelled to carry out repair work outside its own workshop.

3. The guarantee referred to in the third paragraph does not cover the costs of disassembly, labour costs, transport costs and call-out charges, all in the most general sense. These costs will be charged in all cases.

4. No guarantee is provided if:
   changes have been made to the goods supplied by or provided for use by De Haardt Electronic Engineering BV other than by De Haardt Electronic Engineering BV itself or persons expressly authorized by De Haardt Electronic Engineering BV, unless De Haardt Electronic Engineering BV has agreed in writing to such changes in advance;

the defects in the goods supplied or provided for use by De Haardt Electronic Engineering BV are the result of:
neglect of the maintenance of the goods supplied or provided for use by the other party or other users;
improper use or use not in accordance with the instructions supplied by De Haardt Electronic Engineering BV for the installation of the goods;
incompetent use and/or misuse of the goods supplied or provided for use by the other party or other users;
wear and tear;
repairs or replacements carried out by persons other than those expressly authorized to do so by De Haardt Electronic Engineering BV, unless De Haardt Electronic Engineering BV has agreed in writing to such repairs or replacements in advance

5. Work not covered by the guarantee as referred to in this article shall be charged to the other party in accordance with De Haardt Electronic Engineering BV's relevant current tariffs.

6. Notwithstanding the provisions in the preceding paragraphs, the guarantee provided by De Haardt Electronic Engineering BV does not go beyond any guarantee provided to De Haardt Electronic Engineering BV by the relevant manufacturer or supplier of the hardware and/or software and fulfilled in respect of De Haardt Electronic Engineering BV. De Haardt Electronic Engineering BV shall on the other party's request inform the latter of the content of the contracts entered into between De Haardt and its suppliers.