INTERSOFT ELECTRONICS

RADCORE

RDCR992

RADCORE - Radar Data Convertor and Recorder

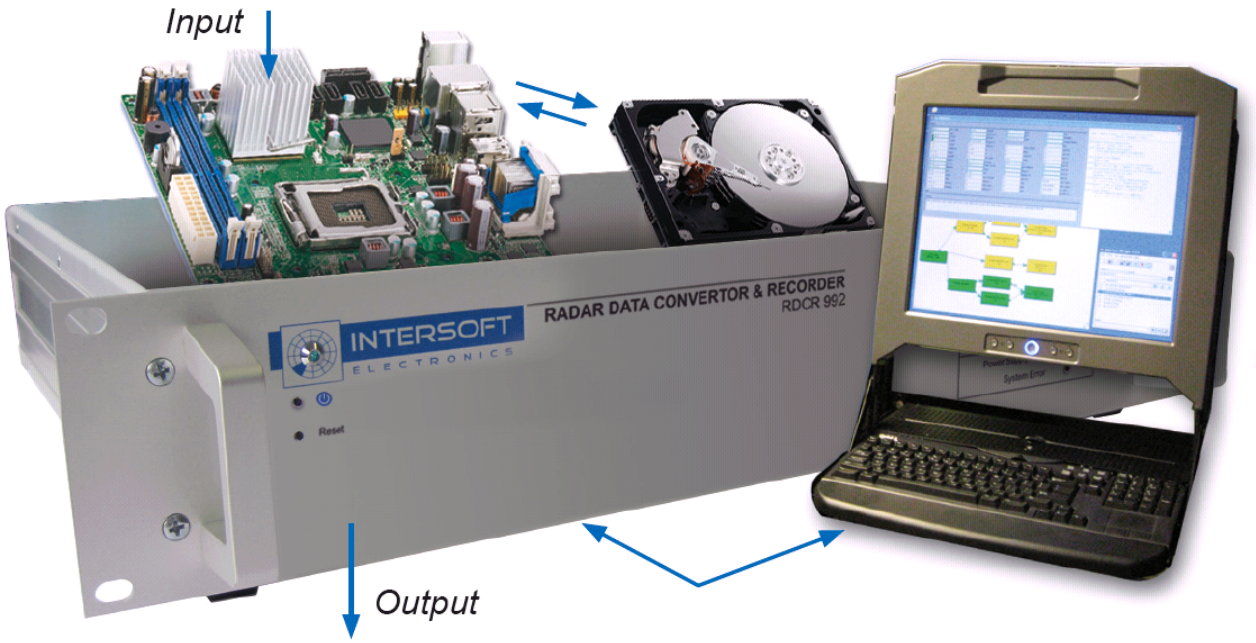

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Table of Contents

Table of Figures

Table of Tables

Conventions Used

Note: This icon to the left of bold italicized text denotes a note, which alerts you to important information.

Caution: This icon to the left of bold italicized text denotes a caution, which alerts you to the possibility of data loss or a system crash.

Warning: This icon to the left of bold italicized text denotes a warning, which alerts you to t he possibility of damage to you or your equipment.

Glossary of Terms

ACP	Azimuth Change Pulse
ARP	Azimuth Reference Pulse
ASTERIX	All Purpose STructured Eurocontrol suRveillance Information EXchange
ATM	Air Traffic Management
BIOS	Basic Input/Output System
CMOS	Complementary Metal-Oxide Semiconductor
COTS	Commercial Off The Shelf
CPU	Computer Processing Unit
DHM	Data Handling Module
Gb	gigabyte
GPS	Global Positioning System
GPS450	GPS unit manufactured by Intersoft Electronics
ICD	Interface Control Document
IE	Intersoft Electronics
IP	Internet Protocol
KVM	Keyboard, Video, Mouse, can be optionally connected to the RDCR992
LAN	Local Area Network
LED	Light-Emitting Diode
NMEA	National Marine Electronics Association is an international standardized message structure that can be used as time message
NTP	Network Time Protocol
PC	Personal Computer
PCB	Printed Circuit Board
PPS	Pulse Per Second, as output by a GPS
PSU	Power Supply Unit
RADCORE	Radar Data Convertor and Recorder
RAID	Redundancy Array of Independent Disks
RASS-R	Radar Analysis Support Systems – Real-time measurements
RASS-S	Radar Analysis Support Systems – Site measurements
RDCR992	Radar Data Convertor and Recorder, product number 992
RMCDE	Radar Message Conversion and Distribution Equipment
RTQC	Real Time Quality Control
SATA	Serial ATA, bus interface to connect hard disks
SNMP	Simple Network Management Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UDR	USB Data Recorder
USB	Universal Serial Bus
UTC	Coordinated Universal Time

1. Introduction

RADCORE, or **Radar Data Convertor and Recorder** is a vital part in connecting a surveillance sensor with an ATC centre, with the ability of a smooth integration of legacy radars in new ATM systems or vice versa.

The combination of **protocol converting** and **data recording simultaneously**, makes Intersoft Electronics' RADCORE the tool for real time **Radar Message Converting and Distribution** (RMCDE equipment) and offline performance evaluation analysis (like ASTERIX validation). Redundant in hardware and modular in software: the RDCR992 will prove to be an invaluable part in the complete radar to ATM processing chain.

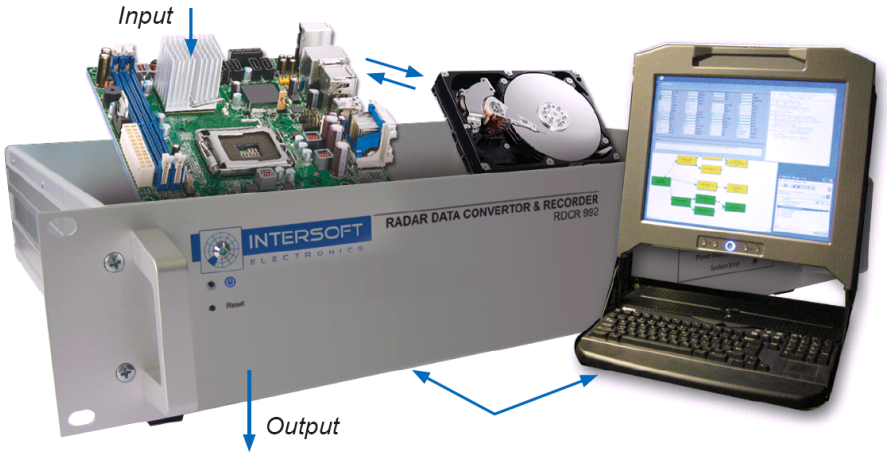

Figure 1.1: RDCR992 with embedded PC and optional KVM connection

1.1. Flexible and redundant in hardware

RADCORE has **4 serial interfaces** which are completely configurable in software. They support various electrical interfaces. It contains an embedded PC with 2 Ethernet interfaces. Therefore, it supports any ATM network architecture: format convert and protocol convert from serial to Ethernet and from Ethernet to serial, or only protocol convert from Ethernet to Ethernet or serial to serial. The additional ACP/ARP input makes it possible to calculate the radar head processor delay.

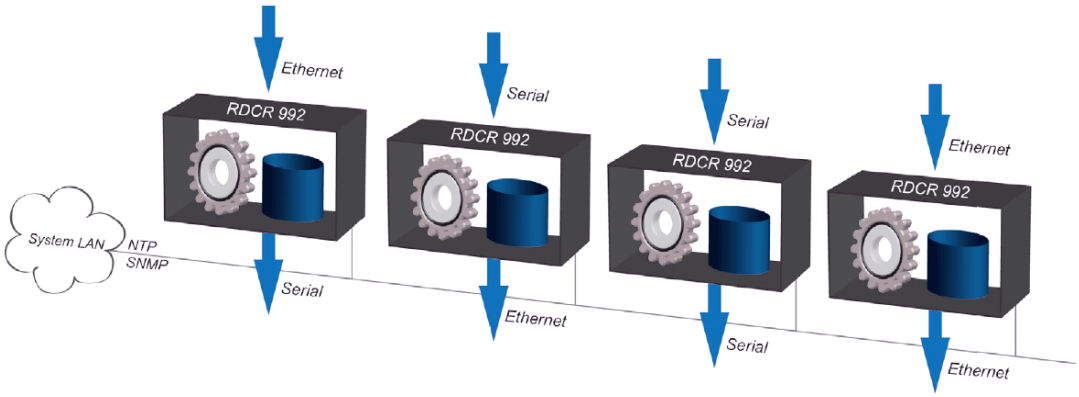

Figure 1.2: Serial and Ethernet interfaces on RDCR992

1.2. Modular in software: protocol convert and recording

RADCORE contains an **embedded PC**, which runs the **RASS-R Data Handling Module (DHM)**, consisting of a **Data Handling Background Server** and **Data Handling Configuration Manager**. In the **graphical user interface**, a radar technician can easily program the input and output of the RDCR992: choose which serial and/or Ethernet port(s) serve as input and output, select the appropriate protocol convert to make and configure the right settings for radar message convert and distribution (RMCDE) and data recording. It is even possible to change in real time a North alignment, or add a range / azimuth offset to the data. When the eccentricity error of the radar encoder is measured, it can be corrected in real time by the DHM processing.

The embedded PC is an **Intel based chipset** with recording capabilities of at least 250GBytes. Connection to the embedded PC can be made with either a remote desktop connection, KVM device directly connected to the rear panel or an Ethernet connection between DHM Background Server and Configuration Manager.

Two Available Gigabit Ethernet ports offer a lot of possibilities. For example, a spare (non-operational) port for remote connection or for synchronization with an external NTP server. Because the RASS-R DHM tool on the embedded PC is a widely proven software tool, it offers unlimited features. For example, a **WatchDog Timer** and **generation of SNMP message**s and alarms for integration in an ATM network monitoring system.

1.3. Recording and analysis of the data

Data recordings made by the RDCR992 are suitable for advanced data replay and further evaluation in **RASS-S** (inventory tool, protocol viewer, **ASTERIX and other protocol validation**), RASS-R (Radar Comparator Mono/ Dual) or for continuous monitoring in the RASS-R Surveillance Monitoring System (SMS).

2. RDCR992 HARDWARE

The following picture is an inside view of the RDCR992:

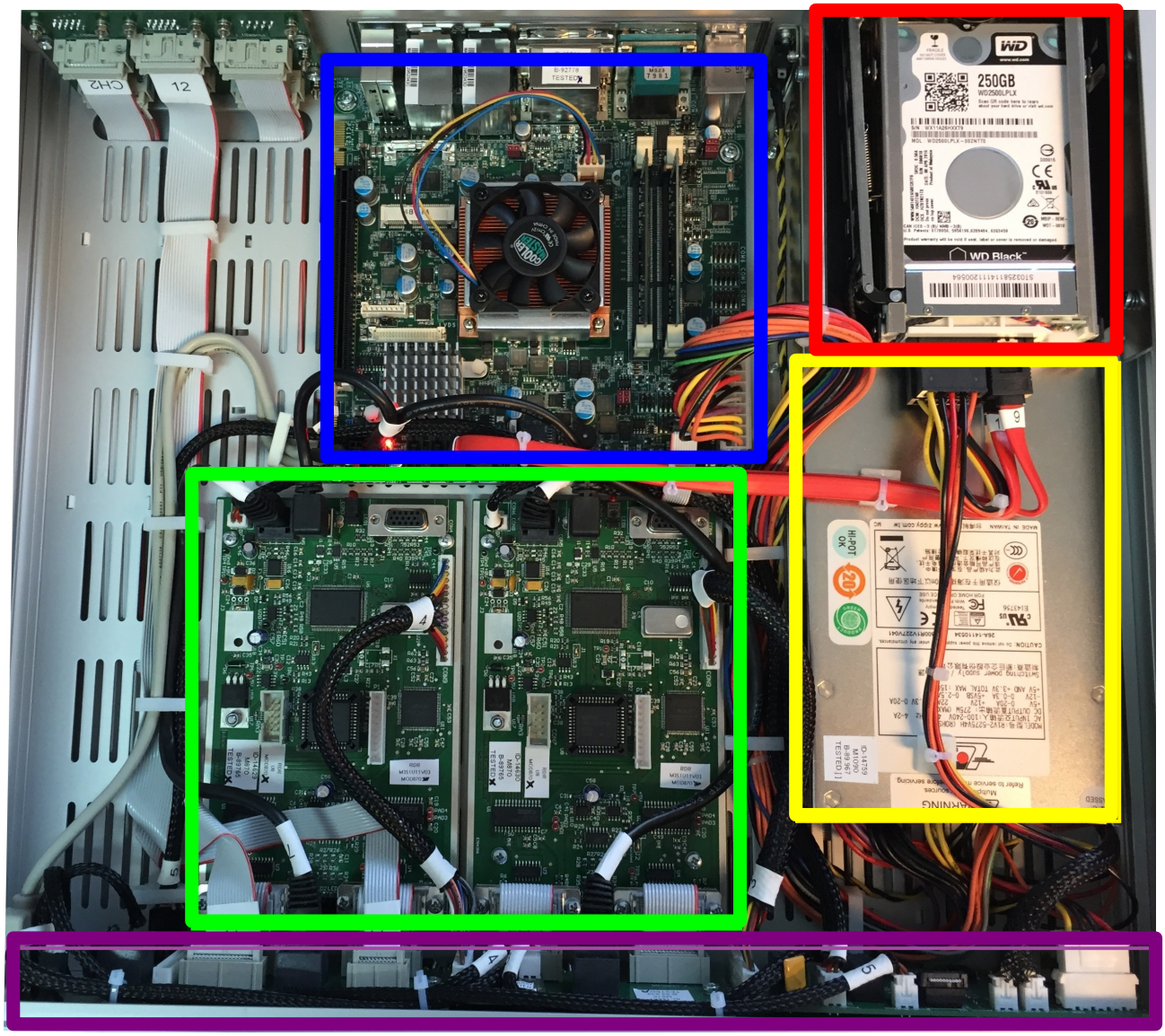

Figure 2.1: Inside view of RDCR992

The RDCR992 contains the following hardware components as can be seen in the picture above:

- **Two serial interfaces or UDR600 (green)**, each having 2 serial ports, connected to the rear side of the RDCR992
- **A micro-redundant power supply (yellow):** to power the embedded PC and UDR600 with 12V and 3V.
- **A front panel PCB (magenta):** to host the watchdog functionality and system interconnection. For

the description of the Watchdog, refer to the user manual of the Watchdog.

- **An embedded PC(blue):** to run the radar data protocol convert software, i.e. the DHM.
- **Two hard-disks (red):** for recording of the data.

The different modules are discussed in detail in the following paragraphs.

Figure 2.2 shows the rear panel of the RDCR992.

Figure 2.2: RDCR992 rear panel

2.1. General specifications

General specifications	
Dimensions WxHxD (mm) and weight	435.8x82.1x360, 19” plug-in box with handles and perforated cover and bottom plate, 7.5kg
Micro redundant hot swappable power supply (PSU)	AC Input: 100-240VAC, 47-63Hz 4-2A DC Output: ATX 12V, 275Watt max. with audible warning and error LED on front panel, reset button in case of faulty power supply, built-in fan
Embedded computer	Mini-ITX PC with Intel Q45 chipset, Intel Core 2 Quad CPU Q9550S 2.8Ghz 1333 12Mb, min. 2GB DDR3 RAM and 2x250GB SATA harddisk in RAID 1 configuration for redundancy, Intel Gen 5.0 integrated Graphics Engine, VGA/DVI output, 2 Gigabit Ethernet ports, 4 USB 2.0, 1 COM port;
Watchdog Timer (WDT)	Built-in WDT in separate micro-controller, with system error LED on front panel
Input for ACP/ARP/Trigger and PPS	DB15HD connector (with output to redundant RDCR992)
NMEA input for UTC time synchronization (coming from Intersoft GPS or time server)	Input for NMEA time string on serial port DB9 female connector (with output to redundant RDCR992)
Environmental conditions: Ambient Temperature Range Relative Humidity Max. operating altitude	 0 - 50 degrees C (operating), -30 – 50 degrees C (Non-operating) 10% to 80% 3080 m
Regulatory Compliance	Rohs. WEEE
Startup time	cold boot (from power shutdown): 90 seconds boot after restart by Watchdog: 140 seconds
Reliability figures according MIL-HDBK217	MTBF (only embedded PC and serial interfaces UDR600): 28935 hours MTBF (total unit): 13746 hours

Table 2.1: General specifications

2.1.1. Temperature of the RDCR992:

The RDCR992 is tested on operational use between 0 and 50 degrees Celsius. In case that the ambient temperature keeps rising, the CPU will stop functioning at 76.3 degrees Celsius at 65Watt. When reaching this maximum temperature, the mechanism of ThermTripping will be activated in order to reduce the heat in the CPU. When the maximum case temperature of the CPU is reached, it will turn the embedded PC off.

2.1.2. Start-up time of the RDCR992:

RDCR992 has two different ways to re-start :cold boot[1] and warm boot[2]. The start-up time for a cold boot is approximately 1 minute and 30 seconds to fully operational. In case of a warm boot (watchdog reset or manual restart) is the start-up time approximately 2 minutes to fully operational. The boot time in this case is longer because you have include the shutdown action of windows.

1 The start-up of a computer from a powered-down, or off, state. Also called “hard boot”
2 Refers to restarting a computer that is already turned on via the operating system. Restarting it returns the computer to its initial state. Also called a “soft boot”.

2.2. Serial interfaces

As one can see on the rear panel of the RDCR992, it contains 4 serial channels numbered 1 to 4 on a **DB15 female serial connector**(refer to Figure 2.3). In the DHM software, they can be configured for input/output RS232/RS422.

RS 232 C Receivers (Compatible with RS232C standard)	
Input Resistance	3 kΩ min, 5kΩ typ, 7 kΩ max
Low threshold	1.2V typ, 0.8 min.
High threshold	1.7V typ, 3.0 max.
Impedance	5kΩ typ (+15V to -15V)
RS 232 C Drivers (Compatible with RS232C standard)	
High Level Output	+5V min, +15V max
Low Level Output	-15V min, -5V max
Short Circuit Current	±100 mA
Power off Impedance	300Ω
Slew Rate	RL=3K, CL=50pF 30V/µs
RS 485[3] Receivers (Compatible with RS485 standard)	
Input resistance common mode	12kΩmin, 15kΩ typ
Receiver sensitivity	±0,2V typ, ±0,3V max
Common Mode Range	-7.0V min, +7.0V max.
Impedance	15kΩ typ (-7 to +12V)
RS 485 Drivers (Compatible with RS485 standard)	
Short Circuit Current	±250 mA
Transition Time	30 ns typ, 50 ns max. (10-90%)
Output current	28 mA min (RL=54Ω)

Table 2.2: Serial interfaces

The pin-layout of the serial channel is as follows:

DB15 pin layout	**DB15 pin layout**
Gnd	1, 8
TxD+ / TxD-A	9
TxD- / TxD-B	2
RxD+ / RxD-A	11
RxD- / RxD-B	4
RxC+ / RxC-A	13
RxC- / RxC-B	6
TrxC+ / TrxC-A	14
TrxC- / TrxC-B	7

Table 2.3: DB15 layout

3 The signal levels and drive capability of the RS-485 drivers allow the drivers to also comply with RS-422 levels.

In case RS232 is selected as input/output layer, only the negative pins are enabled. In case RS422 is selected, both negative and positive pins are used.

The DHM software that controls the RDCR992, can only use channel 1 and 2 as input or output, but not mixed (not possible is channel 1 as input and channel 2 as output or vice versa). The same is true for channel 3 & 4.

2.3. Digital interface

The SK600 is a digital interface to connect **timing signals from the radar**, i.e. trigger/ACP/ARP. Both SK600 connectors are connected to each other so both can be used as input or output. In case of output, this connection can be used to stack the timing signals to another (redundant) RDCR992. In case the dedicated GPS450 is connected, the PPS and GPS data will also be sent on the SK600 that is stacked to another RDCR992.

Digital interface	
Timing in/out SK600	TTL, 10 kΩ (max 0..5 V input)
GPS	Dedicated interface to GPS450

Table 2.4: Digital interface

The pin-layout of the SK600 channel is as follows:

SK600	**DB15HD pin layout**
ARP	1
ACP	2
PPS Event (on the condition that a GPS450 is connected)	3
GPS data (on the condition that a GPS450 is connected)	5
Trigger	14

Table 2.5: DB15HD pin layout

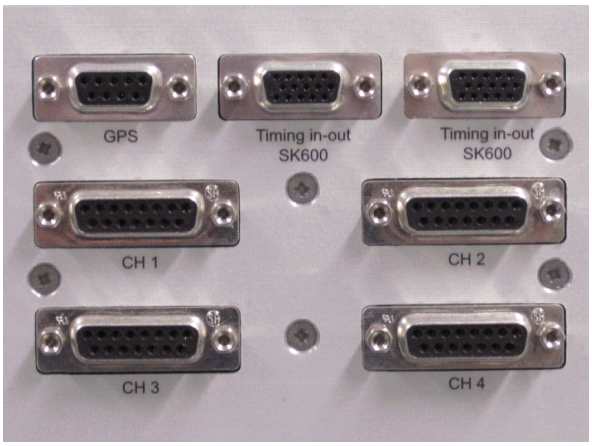

Figure 2.3: Serial and timing interfaces

2.4. Embedded PC

The embedded PC installed in the RDCR992 is equipped with the following characteristics:

- **Hard-disk**: Typically 2 x 250GB 2.5in SATA 7200rpm in a Trayless Hot Swap SATA Mobile Rack Backplane; configured in RAID1 (mirror).
- **Operating system:** Windows 7 (license tag can be found on top of the micro-redundant power supply, inside the RDCR992) or Linux.
- **Installed software**: RASS-R DHM, Watchdog and IE-Proxy
- Network ports are configured as follows: (viewed from rear side)
  - left enabled with static **IP 192.168.0.1** and subnet 255.255.255.0. Remote desktop is enabled to the embedded PC.
  - Right: disabled (Default). This is configurable via the operating system.

The rear panel for the peripherals to be connected looks as follows:

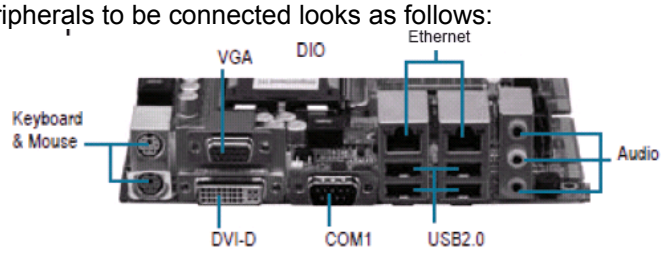

Figure 2.4: Embedded PC rear panel

2.4.1. Specific BIOS settings

- Prevent the PC from stopping starting up when no keyboard connected:

  In the BIOS, select Standard CMOS Features >> Halt On >> All, But Keyboard.

- After power restoration, the RDCR992 should start up automatically:

  In the BIOS, select Integrated Peripherals >> SuperIO Device >> PWRON After PWR-Fail >> ON.

BIOS can be accessed by pressing the DEL button during the start up and on condition that a KVM device is connected to the embedded PC.

2.4.2. RAID Configuration

By default, RAID 1 (mirror) has been configured. Other RAID configurations are available via the Configuration Utility, accessed during start up. (see also chapter Error: Reference source not found)

Configuration Utility can be accessed by pressing the CTRL-I button during the start up and on condition that a KVM device is connected to the embedded PC.

2.5. Front panel LEDs and switches

The front panel has the following LEDs and switches:

Figure 2.5: Front panel LEDs

- **Power on switch**: turns on the RDCR992.
- **Reset button**: resets the total RDCR992 (including a hard reset of the embedded PC).
- **Power on LED**: shows that the RDCR992 has been turned on.
- **RxD LEDs**: shows the presence of data on the receive lines of each channel 1 to 4.
- **TxD LEDs**: shows the presence of data on the transmit lines of each channel 1 to 4.
- **Power Supply Error**: this LED is triggered by the micro-redundant power supply and turns on when one power supply is faulty.
- **System Error**: this LED is triggered by the Watchdog Timer in the micro-controller.
- **2 USB ports**

3. RDCR992 SOFTWARE

3.1. Operating System

The RDCR992 is supplied preinstalled with either Windows7 or Linux, depending on the end user's requirement.

4. BUFFERING MECHANISM

All DHM modules have their own circular **input** buffer with a fixed size of 256 elements and configured in **no-override mode**.

The buffer mechanism is a cascaded based system, because the buffer of the corresponding module is filled by the previous module is the session.

When a buffer is full the module that's writing in that particular buffer will wait until there is space. Meanwhile the buffer of the module that's waiting for space will start filling up. This phenomenon of waiting and buffer filling will continue until all modules are waiting for writing data.

This cascade will continue until the buffer of the inputting UDR module is full and no data will be lost due to the "**wait to write**" mechanism (buffer no-override mode, module needs to wait until there is space). From the moment the UDR module is full, no data can enter the RDCR992 or the RDCR convert session and data will be lost.

The size of each module is fixed to 256 elements but the amount of data that every buffer can contain depends on the message type that the previous module outputs. Each element stores 1 output message of the previous module.

Although every buffer is the same in size (number of elements) they can contain a different number of targets.

5. Micro redundant power supply

The RDCR992 contains a micro redundant power supply that consists of 2 single PSUs (refer to Figure 5.2) Both power supplies run continuously, to power the RDCR992. The RDCR992 requires a single PSU to operate.

Each PSU contains a fan which blows air out the RDCR992. The green LED on the PSU chassis shows if the PSU is operation or not. In case one of the two PSU's fails, the Power Supply Error LED on the front panel (Figure 2.5) will start blinking and an audible alarm will sound. The audible alarm can be reset by the red reset button at the rear of the power supply chassis. The Power Supply Error LED will turn off once the error has been corrected.

Figure 5.1 shows the two PSUs with the red reset button on the rear of the RDCR992.

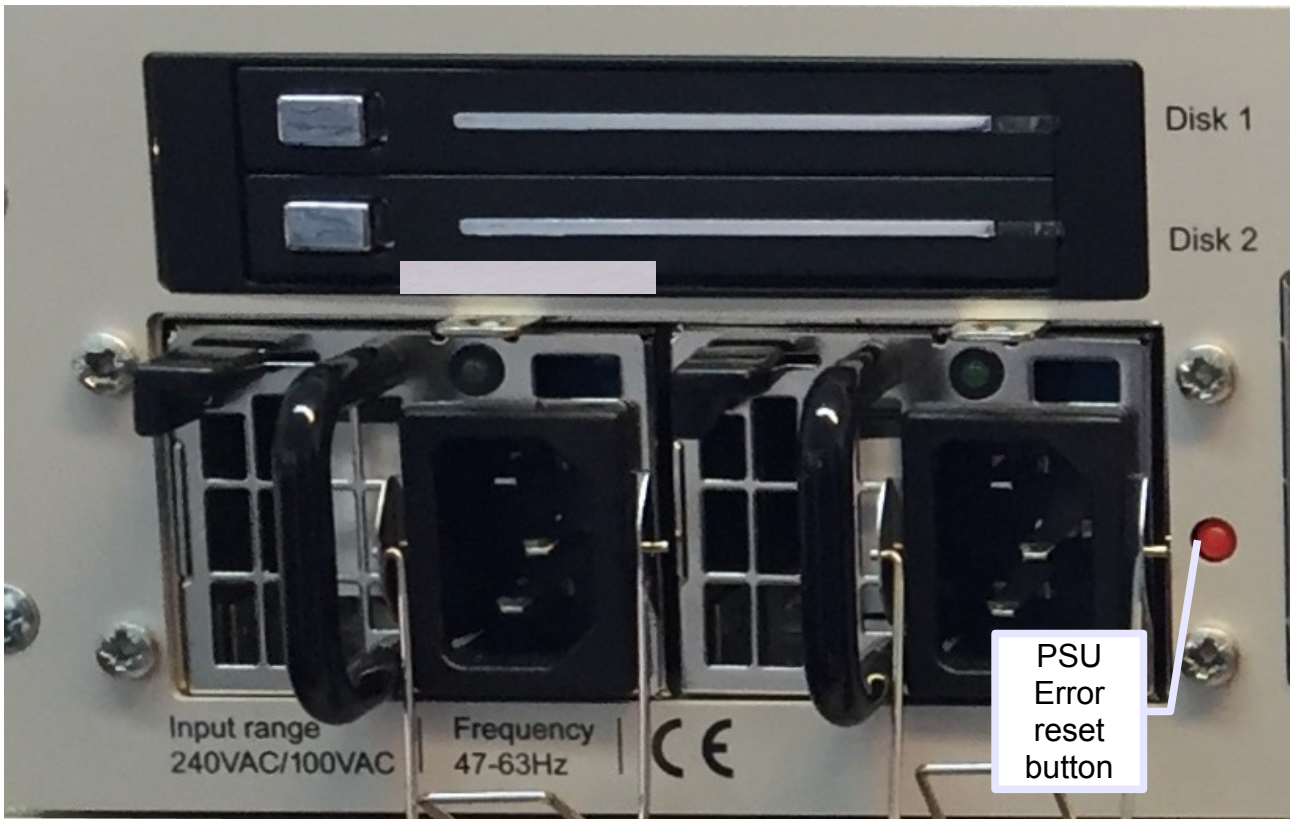

Figure 5.1: Micro-redundant power supply

Figure 5.2: Single Power Supply Unit or PSU

The PSU will not give a signal nor audible alarm when the fan is broken or maximum operating temperature is exceeded.