C02$_{DSP}$ / C04$_{DSP}$
RDS Encoder

User Manual C0xDSP V02.28

May 2017

Content

1. Symbols in this manual

1.1. References and Hyperlinks in this PDF File

The original text document of this manual uses bookmarks for reference purposes. If you read this manual as a non-print version, please note that this PDF file also contains all bookmarks! So you can navigate through the document via the content overview in your PDF viewing software if you activate "bookmarks view".

All references to pages, sections, figures and tables as well as hyperlinks in the text identify a location within this PDF file. Just click the reference to find the referred passage in the text!

1.2. Warning signs and their meaning

The following warning signals are used in this user manual:

⚠	Warning of general danger location
⚡	Warning of electric shock
🔥	Warning of hot surface
🔥	Warning of fire hazard

1.3. Tags and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers. The tags described here are always used only in connection with the related product documentation and the related product.

⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
NOTICE	Describes precautions necessary to protect the equipment.
ⓘ	**NOTE:** Useful information for the user.

2. Introduction

The RDS encoder C02$_{DSP}$ and C04$_{DSP}$ are integrated in 19", 1 RU housings. These RDS encoders are used to transmit RDS data via radio broadcast transmitters. The units are designed for continuous use in unmanned broadcast facilities.

C02$_{DSP}$ and C04$_{DSP}$ have the same basic function, but vary in several features. The basic functions of the units are explained under the designation C0x$_{DSP}$ or "device". The deviating features are explained under the corresponding unit designator C02$_{DSP}$ and C04$_{DSP}$.

ⓘ	**NOTE**: Read this user manual carefully before attempting to operate the unit. Save this user manual for future reference – it contains important safety and operating instructions for the device.

ⓘ	**NOTE**: The figures and graphics in this manual may deviate from the actual appearance. Errors and omissions excepted. Configurations, functions, and specifications may change for further development without notice.

3. Safety Instructions

For a secure operation of the device the user should read and hold on all safety instructions mentioned in this manual before the first operation.

⚠️ **WARNING**	Non-compliance with the safety instructions can lead to serious injury.

Any changes on the device or operation of the parts not having been proved and released by the manufacturer can lead to unforeseen damage.

Every improper use of the device and all actions on the device not mentioned in this user manual are regarded as a not allowed misuse outside the statutory limits for liability of the manufacturer.

If you sell the device or give it to another person, attach this user manual to the device.

Never operate the device, if it does not function properly. If the device or its part is out of order, put it out of operation. Never repair the device by yourself. If there are any damages in the device, send it immediately to 2wcom Systems for maintenance or dispose it professionally according to the regional disposal regulations.

Keep the device away from unauthorized persons.

⚠️ DANGER

	DANGER of electric shock
⚡	Plug the device into a grounded power socket only. Never remove the grounding wire/contact.
	Never open the housing of the device by yourself. Never touch open electrical parts.
	Dangerously high voltages are present inside the housing. Even after disconnecting the mains supply, dangerously high voltage levels may be present for a certain time.
	Do not touch the device with wet hands.
	Never expose the device to liquids. If any liquid comes inside the housing, immediately disconnect the device completely from the power supply. Do not continue operating the device.
🔥	**FIRE HAZARD of overheating or electric shock**
	Ensure sufficient heat dissipation during operation. Avoid following when installing the device:
	– non-ventilated environment, for example a narrow shelve or built-in wardrobe;

	– extremely warm or cold place; – direct sunlight exposure; – too high or too low temperature; – extremely wet or dusty environment. Do not operate the device in the presence of flammable gases. Do not cover the ventilation openings of the device to avoid heat accumulation. Do not put objects with open flames such as burning candles on the device. Do not put heavy objects on the supply cord. A damaged cord can lead to fire or electric shock hazards. To disconnect the supply cord, drag always the plug and never the cable to avoid the cord damage.

⚠ WARNING

⚠	**WARNING of explosive atmosphere** Risk of the explosion hazard. Do **not** use the device in an explosive environment.
⚠	**WARNING of hot surface** The surface of the device can heat up during operation. The device is equipped with a passive cooling system. Do not touch the surface of the device during operation.

NOTICE

	CAUTION: Risk of equipment damage *Before the first operation:* Check the housing, the front panel, the supply cord and the plug for visible damage (e.g. scratches, cracks, damaged isolation and abrasion) In case of damage, unplug immediately the supply cord. Never operate device with a damaged supply cord. All damaged components must be replaced immediately.

Installation:

Use only a grounded three-wire power supply cord and -plug that complies with the national regulations.

If necessary, another than the supplied supply cord has to be used, in compliance with the regulations of the country where the device is operated.

Make sure that the AC power outlet is next to the device and readily accessible to the user.

Installation of other devices:

External devices which are connected to the device could be damaged by the device or damage the device itself if the output levels exceed the specified limits.

Cleaning:

Do not use corrosive detergents on the device such as benzine, thinner, alcohol or acetone. Clean the surface of the device only with a soft dry cloth.

4.   Supplied Parts

	C02$_{DSP}$	C04$_{DSP}$
1 x power supply cord*	X	X
2 x BNC cable (optional: ask for the price)	on request	
1 x RJ45 patch cable	-	**
1 x PC software for remote operation to download	X	X
2 x 25-pol D-Sub connector (soldering) for GPIO [Optical Coupler Input]/ [Relay Output] (free)	on request	
1 x serial RS-232 crossover cable (D-Sub 9 pole)(free)	on request	
1 x user manual in PDF format to download; on request by paper	X	X

*   available for different countries

**   for units with TCP/IP-module only

NOTE: The scope of delivery may deviate in special cases.

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5. Manufacturer

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Phone (+49) 461 – 662830-0 • Fax (+49) 461 – 662830-11

contact@2wcom.com • www.2wcom.com

6. Installation

Best setup location

The device should be installed in a 19" rack. Avoid direct sunlight, proximity to radiators and air conditioning, dust, water, and chemicals. Choose a rack location that permits a clear view of the indicators on the device and ensure a sufficient heat dissipation of the device.

Mains supply connection

The device is designed for operation with 100 to 240 V AC, 50 to 60 Hz. Check the corresponding device labeling for compatibility to the domestic line voltage and frequency before connecting the IEC power connector to the mains supply!
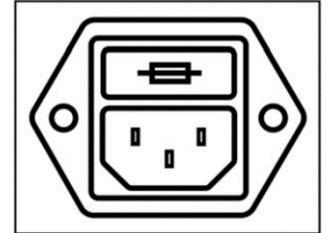
No power switch is available; unplug mains supply connector to remove power. Keep the mains supply plug readily accessible to the user.

⚠ WARNING

⚠	**WARNING** Disconnect mains power plug before you open the housing. Repair of the equipment must only be carried out by authorized and qualified personnel. Read also section "Safety Instruction" on page 8.

7. First steps

7.1. How to connect the signal cables (point of summation)

A suitable point of summation is necessary to add the generated RDS signal to the stereo or mono MPX signal. Additionally the RDS signal should be synchronized to a 19 kHz pilot tone to achieve a signal according to the specifications. The cabling depends on these requirements.

7.1.1. Installation variant 1

Installation scheme with stereo generator (e.g. our S02)
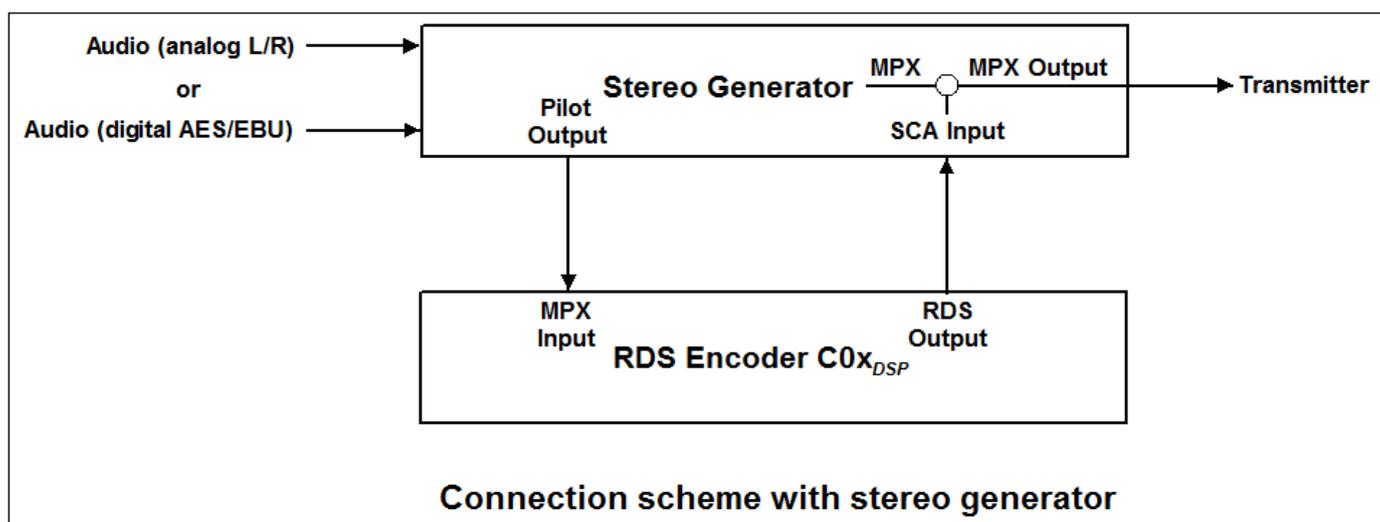
Figure 1: Connection scheme with stereo generator

Point of summation for adding the RDS signal to the MPX signal: Usually the additional signal (SCA) input of a stereo generator (e.g. 2wcom S02) is used to add the signals inside the stereo generator (see Fig. "Connection scheme with stereo generator"). Therefore the auxiliary pilot output of the stereo generator has to be connected to the/an MPX input (MPX Input 1/2) of the C0x$_{DSP}$ for synchronization and the RDS output (RDS Output 1/2) of the C0x$_{DSP}$ to the additional signal (SCA) input of the stereo generator. The MPX-Bypass in the C0x$_{DSP}$ has to be switched off. In order to do so, please use the supplied software "Arcos Config" and check the tab [General] to see if the checkbox [MPX Bypass] is deactivated; if not, deactivate it and click on the button [Send] to send the changes to the C0x$_{DSP}$. If there is no auxiliary pilot tone, it is possible to synchronize the RDS signal to the pilot carrier of the MPX-signal.

7.1.2. Installation variant 2

Installation scheme without stereo generator
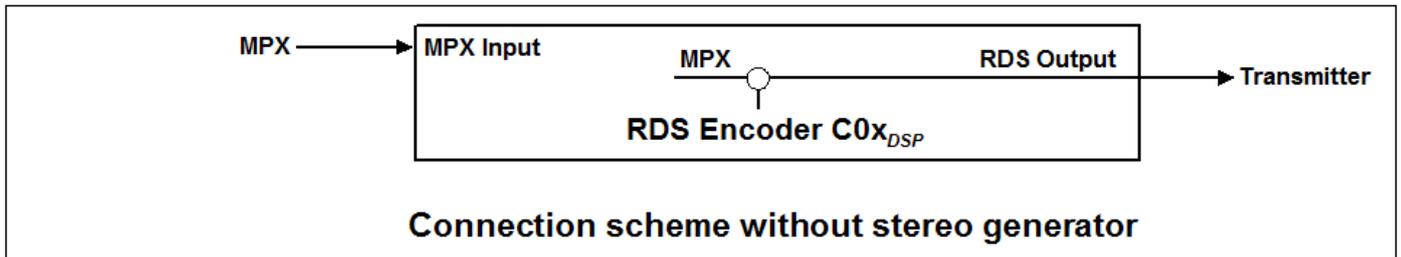
Figure 2: Connection scheme without stereo generator

If there is no stereo generator, the point of summation integrated in the C0x$_{DSP}$ can be used. Therefore the MPX source must be connected to the/an MPX input of the C0x$_{DSP}$ and the MPX bypass in the C0x$_{DSP}$ must be switched on. In order to do so, please use the supplied software "Arcos Config" and check the tab [General] to see if the checkbox [MPX Bypass] is activated; if not, activate it and click on the button [Send] to send the changes to the C0x$_{DSP}$. The synchronization of the pilot tone works automatically. The synchronization of the pilot tone works automatically.

No synchronization is required if a transmission system without pilot tone is being used. A crystal oscillator then generates the 57 kHz carrier and the red 'Pilot' LED turns on.

7.2. How to turn on the device

Before connecting the C0x$_{DSP}$ to the main supply, verify that the supplied C0x$_{DSP}$ is specified to work with the available mains voltage and frequency. Then connect an appropriate supply cable to the mains socket. The device then turns on and initiates a warm start. The settings of the unit are stored in non-volatile memory and are read out to generate the RDS signal.

A cold start can be carried out by using the provided "Arcos Config" program (C0xDSP setup software for PC) or by means of the reset button on the front side of the encoder (see page 16). After a cold start, the encoder will be loaded with default values.

When you receive the encoder, it is set to default values e.g., for phase delay and signal level. These values are non-volatile stored in an EEPROM and are loaded after every cold- and warm start. Therefore the encoder is operational at any time.
The configuration of the serial RS-232 interfaces on delivery of the unit can be set to standard settings or can be set to customized settings. Details of the possible configurations can be found on page 32.

NOTE: Application in Europe
A stereo transmission system with a 19 kHz pilot tone is used. After the installation in the system, a phase adjustment of the 57 kHz pilot signal should be carried out and the level needs to be checked.

> **ℹ** **NOTE: Application outside Europe**
> A considerably higher level is used compared to Europe. If no pilot tone is used (mono operation) phase adjustment is not necessary. Please pay attention for a correct impedance matching to the transmitter.

7.3. Phase balancing

After the installation of the RDS encoder in systems with pilot signal it is a good practice to perform a check / balancing of the phase delay between the pilot signal (19 kHz) and the RDS signal (57 kHz). This ensures to have the lowest possible FM deviation for RDS.

This balancing is necessary for the compensation of a possible phase delay in the transmitter system. In systems without pilot signal (monophonic), this phase balancing is not necessary.

Note that other signals like the program modulation (speech/music) need to be turned off during the measurement. To perform the check you need an oscilloscope. Where to connect the oscilloscope depends on the installation variant as described on page 14).

7.3.1. Measurement

Installation variant 1: Connect the oscilloscope to the MPX output of the stereo generator

Installation variant 2: Connect the oscilloscope to the RDS output of the C0x$_{DSP}$ RDS encoder or to the output of the last part in the chain before the transmitter.

If you do not measure a symmetric signal like in Fig. "90° phase delay RDS/19 kHz" you can adjust the phase setting of the encoder via „Arcos Config" by data connection (C0x$_{DSP}$) or directly via the LCD menu (C02$_{DSP}$) to achieve a symmetric signal with two peaks of the same amplitude.

90° phase delay RDS/19kHz
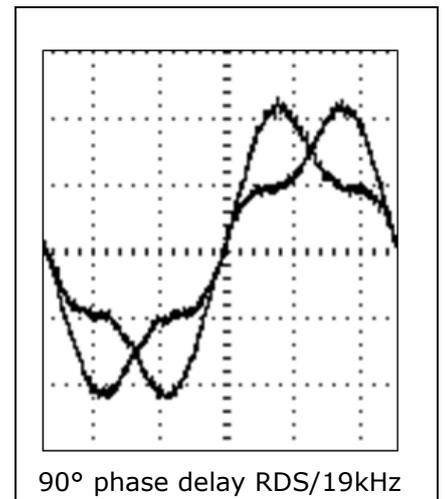
> **ℹ** **Note:** Waveform readability depends on RDS/Pilot signal voltage ratio.

7.3.2. Carrying out of a cold- and warm start

A cold- and a warm-start can be carried out by the Arcos Config software, included in the delivery or just by using the pinhole reset button. The pinhole reset button can be found on the front side

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of the encoder behind a little opening to the right of the LED's (use a bent paperclip or similar for actuation).

7.3.3. Warm start by means of the reset button

The button has to be pressed with a suitable object such as a bent paper clip at least until all LED's on the front panel of the C0x$_{DSP}$ are turned off. If the button is released at that moment, the encoder carries out a warm start (all data remains).

7.3.4. Cold start by means of the reset button

The button has to be pressed at least until all LEDs on the front panel of the C0x$_{DSP}$ are turned off. If the reset button is pressed two to three seconds longer, all LED's on the front panel are turned on and the encoder is carrying out a cold start. The encoder is operational a few seconds afterwards.

7.4. How to update the Firmware

All necessary data for the firmware update will be provided as a self-extracting executable file. The file name includes the current version of the firmware (e.g., the C04DSP_V1_16.exe includes the V1.16 firmware version for the C0x$_{DSP}$). At present, the same firmware packages are used for the C02$_{DSP}$ and the C04$_{DSP}$. Therefore a C04$_{DSP}$-image can be loaded into a C02$_{DSP}$.

For a firmware update, copy the firmware file (e.g., C04DSP_V1_16.exe) into any directory and start the file. The individual images are being unpacked automatically and the flash tool will start. The flash tool loads all necessary images automatically.

Firmware updates can be carried out through the front interface (RS-232) of the C0x$_{DSP}$ only. Connect the encoder through the delivered serial cross-link cable to your computer and select the appropriate PC interface in the flash tool. The baud rate is automatically adjusted to correspond with the baud rate of the front interface. If the C0x$_{DSP}$ has the option "LINK", it is necessary to ensure that the front interface is set to UECP mode.

After starting the update process, three images are being loaded into the C0x$_{DSP}$ encoder. When the update is completed, the unit is carrying out a restart.

The unit carries out a warm start by default. The unit carries out a cold start instead if at least one of the following properties has been changed by the update: version of the firmware, date of the firmware, storage structure of the RDS specific data.

If an error occurs during the firmware update process, it is usually possible to simply restart the process.

The image file of the firmware is usually not included on the enclosed CD. In case of a necessary update, it is a pleasure for us to send you the image file together with the appropriate update tools.

8. Control elements and Connectors

8.1. Front Panel

Front Panel C02$_{DSP}$
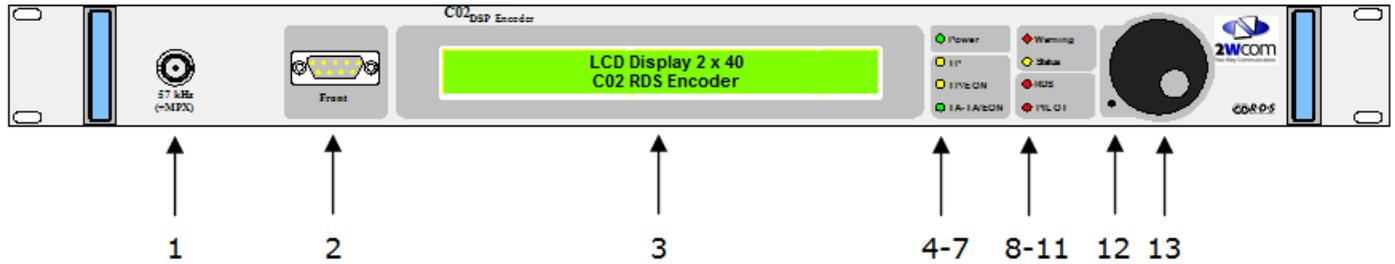
Front Panel C04$_{DSP}$
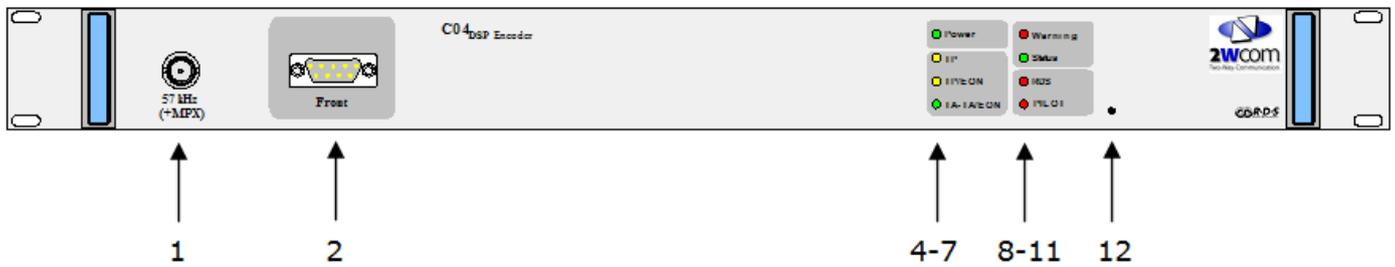
1	[57 kHz (+MPX)]	BNC; RDS monitoring output
2	[RS-232]	D-Sub 9 pole male; serial RS-232 interface
3	LCD screen	Illuminated LCD display, 2 x 40 characters
4	[Power]	LED indicator (green); active if mains supply is ok
5	[TP]	LED indicator (yellow); active if TP (Traffic program) is activated
6	[TP/EON]	LED indicator (yellow); indicates if TP/EON is activated (referenced traffic program). The LED is active if the main PSN TP=0 and TA=1 and exactly one EON switches TP=1.
7	[TA - TA/EON]	LED indicator (green); active if the main PSN currently transmits a traffic announcement (main PSN TP=1 and TA=1) or an EON PSN with TP=1 switches TA=1.
8	[Warning]	LED indicator (red); active if a device warning message occurs.
9	[Status]	LED indicator (C02$_{DSP}$: yellow / C04$_{DSP}$: green); Active if ARI (option) is activated.
10	[RDS]	LED indicator (red); active if no RDS signal is generated
11	[Pilot]	LED indicator (red); active if no or weak pilot input signal is detected.
12	Reset button (behind hole)	Push button behind the hole in the front panel. Can be activated with a bent paperclip or similar.

| 13 | [Jogwheel] | Navigate (rotate) and activate (push) inside the displayed menu structure |

NOTE: Figures may deviate from supplied unit.

8.2. Back Panel

Rear panel C02$_{DSP}$ (and C04$_{DSP}$ with TCP/IP module)

Back Panel C04$_{DSP}$

1	Power supply connector	Standardized supply connector with integrated fuse holder. Fuse rating depends on mains supply voltage: 100-120 V: T1.6 A (time lag); 5x20 mm; IEC; 250 V 220-240 V: T1.0 A (time lag); 5x20 mm; IEC; 250 V
2	[Service]	D-Sub 9 pole male connector; This interface is for servicing purposes only. No configuration or communication to the C0x$_{DSP}$ possible. (Dummy connector if no TCP/IP module installed)
3	[10/100-Base-T]	RJ-45 jack for a 10/100MBit IP connection to an IP-network. Can be used to configure and operate the unit via remote control. IP-parameters of the unit are setup via front panel (C02$_{DSP}$) or Arcos Config (C0x$_{DSP}$). Users of a C02/C04$_{DSP}$ with TCP/IP interface please also see page 26.
4	[Remote Control Relay Output]	D-Sub 25 pole male connector; provides access to the internal relay contacts. It is possible to assign functions to individual relays by using supplied software tools
5	[Remote Control Optical Coupler Input]	D-Sub 25 pole female connector; provides access to the internal non-floating opto-isolated inputs. It is possible to assign functions depending on the state of the opto-isolated inputs.
6,7,8	[DTE1], [DTE2], [DTE3]	D-Sub 9 pole male connector; serial RS-232 interface

9	[MPX Input 1]	BNC connector; Input for feeding in a pilot or MPX signal
10	[MPX Input 2]	BNC connector; Input for feeding in a pilot or MPX signal
11	[RDS Output 1]	BNC connector; Output for generated RDS signal
12	[RDS Output 2]	BNC connector; Output for generated RDS signal

> **(i)** **NOTE**: Figures may deviate from supplied unit.

9. Operation

9.1. Operation of C04$_{DSP}$

The units do not have operation elements and no LCD display. They are operated via the supplied PC software "Arcos Config" and/or UECP MEC commands by remote control (standard UECP commands can be found in the UECP Specification SPB 490 V.6.0). The C02$_{DSP}$ offers this function additionally.

9.2. C02$_{DSP}$ Operation via menu

The C02$_{DSP}$ has an easy to handle menu structure. The [Jogwheel] can be rotated left and right to highlight displayed menu buttons. A highlighted menu button is indicated by a "→" cursor symbol left to the soft button. To navigate into the highlighted menu button, the [Jogwheel] has to be pushed once. This works on every soft button that contains a submenu. To navigate to the previous menu, the "Back" menu button has to be highlighted and selected (rotate and push the [Jogwheel]). To change settings or values, the part to be changed has to be highlighted and selected. The configurable part is indicated by the symbols ">" and "<" and can be adjusted by rotating the [Jogwheel]. To confirm the configuration, the [Jogwheel] has to be pushed once. Afterwards the [Jogwheel] can be used for navigation as before.

For a better overview during navigation through the menu, every listed entry below shows the corresponding menu path.

Example: `Main menu>Menu [Coder]`

9.2.1. Status screen – display of the operating parameter

After turn on the LCD shows a status screen which shows an overview of the current operating parameter.

```
Press      │ DSx      PS=Name     TP=1     TA=0
Enter      │ PIhex   RDS=xxxmVpp  MPX Input= 1
```

The status screen shows seven status settings.

- DSx: Indication of active dataset
- PIhex: PI code as hex value
- PS=Name: PS station name that is shown on RDS radios
- RDS=xxxmVpp: adjusted RDS signal level in mVpp
- TP=:   Indication of TP bit status (traffic program)
- TA=:   Indication of TA bit status (traffic announcement)
- MPX Input=:   Indication of selected MPX input for synchronization.

9.2.2. Main menu

Most of the settings are available via the menu structure of the unit. Additional settings are available via "Arcos Config" PC software. The contained entries of the menu are described below. The listed order follows the menu structure of the unit.

The main menu has the following structure:

```
C02     |Coder       Interface
Vx.xx   |Setup       Diagnostic        Back
```

The leftmost part shows the version of the firmware.

9.2.3. RDS parameter

Main menu>Menu [Coder]

This menu shows submenus for configuring most of the available parameter for the RDS encoding.

```
Coder | DS      Level      Phase      MPX Inp.
      | RDS     VRF        Calibr.        Back
```

9.2.3.1.   Data set memories

Main menu>Menu [Coder]>[DS]

This menu shows a selection for choosing the active data set. The corresponding PS (station name) of each dataset is shown additionally. The unit has eight data set memories. Each data set contains most of the configurations, which setup the RDS encoding. The data set memories are setup according to the RDS UECP specification V6.0.

9.2.3.2.   RDS signal level

Main menu>Menu [Coder]>[Level]

This menu can be used to show and setup the RDS and the ARI generator level. Additionally the menu shows the sum of both levels.

9.2.3.3.   Signal phase delay configuration

Main menu>Menu [Coder]>[Phase]

This menu can be used to show and setup the phase delay between the RDS signal (57 kHz) and the pilot signal (19 kHz). Additionally the menu shows the fixed phase delay of 90° ([VRF]) between the RDS and the ARI signal.

9.2.3.4.   MPX input selection

`Main menu>Menu [Coder]>[MPX Inp.]`

This menu can be used to select the MPX input, which should be used for the synchronization to a pilot signal. * The setting does not get lost by a cold start.

* ≥ HW rev. 2.00

9.2.3.5.   RDS generation on/off

`Main menu>Menu [Coder]>[RDS]`

This menu can be used to turn the RDS signal encoding [On] or [Off]. Additionally [Mode] offers to select between [normal] and [binary] encoding mode. The [binary] mode can be used for testing. Note that this mode cannot be used to encode a valid RDS signal.

ⓘ   **NOTE**: Note that this mode cannot be used to encode a valid RDS signal.

9.2.3.6.   ARI, DK / TA, and BK configuration

`Main menu>Menu [Coder]>[VRF]`

(Optional*) This menu can be used to turn the [VRF] (ARI) encoding [On] or [Off]. [DK/TA] can be used to turn the traffic announcement indication (ARI) [On] or [Off]. Additionally [BK] can be used to setup the traffic area identification signal for ARI (0, A…F).

```
Coder  |VRF        DK/TA        BK
VRF    |Off        Off           0        Back
```

* ARI option is discontinued in firmware versions 2.x and above

9.2.3.7.   Reference table setups

`Main menu>Menu [Coder]>[Calibr.]`

This menu can be used to assign an individual reference table for [MPX Input1] and [MPX Input2]*. The unit has six reference tables. These tables contain level and phase settings for a quick adaptation to different transmitters and synchronization sources.

* [MPX Input 2] only HW rev. ≥ 2.00

9.3. Interface configuration

`Main menu>Menu [Interface]`

This menu contains submenus for the configuration of the interfaces. These are: the serial front interface [Front], the serial rear interfaces [DTE1], [DTE2], [DTE3] and the [TCP/IP] interface (10/100-Base-T).

```
Interface │ Front     DTE1      DTE2      DTE3
          │ TCP/IP                         Back
```

9.4. RS-232 serial interface configuration

`Main menu>Menu [Interface]>Submenu [Front] and [DTE1] – [DTE3]`

The submenu [Front] can be used to configure the serial interface on the front panel. The submenus [DTE1], [DTE2], and [DTE3] configure the serial interfaces on the rear panel. All interfaces offer the same settings. It is possible to setup the baud rate, the interface protocol (UECP or LINK*), and the response type for data acknowledge. The RS-232 bit and parity settings cannot be changed and are fixed on: 8 data bits, 1 stop bit, and no parity (8/N/1). The configuration of the timeout setting can be found on page 28.

```
Interface │ Baud      Prot      Response
   xxx    │ xxx       xxx          xxx      Back
```

*Requires option LINK, LINK protocol is discontinued in versions V2.x (or higher)

9.4.1. Interface speed setup [Baud]

This entry can be used to setup the serial RS-232 interface speed. The available speed rates can be seen from the table to the right:

1200	Baud
2400	Baud
4800	Baud
9600	Baud
19200	Baud
38400	Baud

9.4.2. Interface protocol setup [Prot]

All C0x$_{DSP}$ encoder support the UECP protocol V6.0. C02/C04$_{DSP}$ supports the Link protocol as an option. The following protocols are available:

[UECP]	Communication using the UECP protocol
[LINK]	Communication using the LINK protocol (LINK option required, only supported in versions lower as V2.x)
[TERM]	Serial Interface acts as Terminal for the Automation Interface
[AUTO]	In Auto mode, the serial interface automatically detects if data is UECP or Terminal data

9.4.3. Acknowledge mode setup [Response]

This entry can be used to setup the operation mode of the serial RS-232 interfaces. Acknowledge modes can and should be activated in the C0x$_{DSP}$ encoder and the control PC software to make the UECP data communication more robust to avoid data errors. The following modes are available when interface is configured as UECP:

[None]	Unit does not send any acknowledge responses.
[Request]	Unit sends an acknowledge response only on request of the control software.
[Spontan]	Unit sends an acknowledge response for every received UECP frame.

When the interface protocol is configured as TERM:

[Echo ON]	Terminal echoes back input data
[Echo OFF]	Terminal does not echo back input data

In case the interface is configured as AUTO, [None] is bundled with [Echo OFF], while [Request] and [Spontan] are bundled with [Echo ON].

9.5. TCP/IP network interface configuration

Main menu>Menu [Interface]>Submenu [TCP/IP]

This menu can be used to configure the internal 10 / 100 MBit TCP/IP interface. The IP-addresses are stored in the internal EEPROM.

```
Interface│ IP Address =255.255.255.255
TCP/IP   │ Netmask    =255.255.255.255
```

The following parameters are displayed and can be configured:

[IP-Address]	Individual address, which is necessary to identify a hardware device in an IP network like the internet or intranet.
[Netmask]	Bit mask, which separates an IP address into a network part and a host part.
[Gateway]	Address of the intranet computer that acts as a gateway to the internet.
[SNMP IP 1]	Address of the system that receives the SNMP events/traps of the C0x$_{DSP}$.
[SNMP IP 2]	Address of the system that additionally receives the SNMP events/traps of the C0x$_{DSP}$. Deactivation: This additional function can be deactivated by setting the IP address to 0.0.0.0

[SNTP IP]	Address of the NTP Time Server that is used to synchronize the system time after a system restart or hourly if accessible*. Via SNMP it is possible to setup an individual synchronization interval. * Requires option SNMP
[Port n]	TCP and UCP Port address that is used for data communication with the device. Both protocols can be used at the same time. Port 2-4 can be set to 0 in order to deactivate the port. Port 1 can never be deactivated. Note: Configurable on units with firmware V1.49 (or higher) with TCP/IP module firmware V1.36. Not configurable on units with older firmware versions (then fixed on 6666). 4 ports available only with firmware V2.04 (or higher) and TCP/IP module firmware V3.01 (or higher)
[Port AS]	TCP and UDP Port address (parallel) for Automation System data (Terminal) **Note**: available only with firmware V2.04 (or higher) and TCP/IP module firmware V3.01 (or higher), cannot be used for UECP communication
[Port Dec.]	Port address for access to the RDS Monitoring function via 2wcoms RDS Lab (RDS Monitoring is optional). See the RDS Lab manual for more information **Note**: available only with firmware V3.14 (or higher) and TCP/IP module firmware V3.27 (or higher)

The necessary TCP/IP interface settings above do depend on the individual network and should be assigned by a responsible network administrator.

The settings can be changed as follows:

Use the [Jogwheel] to highlight an address type. To do this, rotate the [Jogwheel] left and push it one time for editing. The address part to be edited is then marked by the symbols ">" and "<". Rotate the [Jogwheel] to edit the first part of the address. Push the [Jogwheel] one time and edit the second part of the address as described before. Continue until the last of the four parts of the address is edited. After the last edited part has been confirmed by a push on the [Jogwheel] it is possible to navigate in the TCP/IP menu again. The settings are activated by leaving the TCP/IP menu!

C04$_{DSP}$ and C02$_{DSP}$: It is possible to configure the TCP/IP interface settings of the unit via Arcos Config (Tree Menu: Encoder symbol selected- Tab: Hardware Setup > TCP-IP settings) with an active RS-232 or IP connection to the unit. The settings are immediately activated by an automatic warm start of the device! Be advised, that if the device is configured via network and the IP parameters were changed, that Arcos Config might not be able to reconnect until these parameters are updated in the Tree Menu.

* Requires option SNMP

9.6. Basic settings

`Main menu>Menu [Setup]`

This menu shows submenus for the configuration of basic settings of the unit.

```
┌─────────────────────────────────────────────────────────────┐
│ Setup  │ Timeout         Units                               │
│        │ Messages        Language              Back          │
└─────────────────────────────────────────────────────────────┘
```

9.6.1. Serial RS-232 interface timeout configuration

`Main menu>Menu [Setup]>[Timeout]`

The submenu [Timeout] can be used to set a timeout for each serial RS-232 interface. If a communication pause exceeds the configurable delay time, the LED [Warning] is activated and a warning action is initiated. Possible delay times are between 1' and 254' (minutes). Additionally this function can be turned [Off] individually. A warning action has to be configured by the user. Possible are: Assigning the function "timeout" to a relay or enable an SNMP event/trap (requires option SNMP).

```
┌─────────────────────────────────────────────────────────────┐
│ Setup   │ DTE1      DTE2      DTE3      Front                 │
│ Timeout │ Off       Off       Off       Off          Back    │
└─────────────────────────────────────────────────────────────┘
```

9.6.2. Select unit for the level display

`Main menu>Menu [Setup]>[Units]`

This submenu can be used to choose the unit for various level displays. Possible are [mVpp] and [kHz] (corresponding signal deviation).

9.6.3. System- and error message generation configuration

`Main menu>Menu [Setup]>[Messages]`

The generation of error messages can be prevented. To do this, the parameter [Error] must be set to [Off]. The menu entry [System] has no function.

9.6.4. Select language

`Main menu>Menu [Setup]>[Language]`

This submenu can be used to select the language setting of the unit. Possible settings are [English] and [Deutsch].

9.7. Self tests and diagnostic

`Main menu>Menu [Diagnostic]`

```
Diagnostic|  Hardware         Messages
          |  Configuration             Back
```

9.7.1. Check unit functions

`Main menu>Menu [Diagnostic]>[Hardware]`

This submenu shows device functions, which can be checked for basic functionality. These include the LEDs, the opto-isolated inputs, the relay, and the real-time clock.

```
Diagnostic |  I/O Test      Clock
           |  Remote In      Relay        Back
```

9.7.2. Display- and input/output test

`Main menu>Menu [Diagnostic]>[Hardware]>[I/O Test]`

This mode activates the LEDs cyclically (but power LED is activated continuously). Additionally the opto-isolated inputs are coupled to the relay (e.g. the opto input 3 activates the relay 3).

9.7.3. System clock time

`Main menu>Menu [Diagnostic]>[Hardware]>[Clock]`

Displays the present time of the internal clock without any offset. The internal clock can be synchronized to an NTP time server via TCP/IP (SNTP) if available (hourly / at device restart)*. Via SNMP (sntpUpdateInterval) it is also possible to set an individual synchronization interval time.

* Function only available with option SNMP.

9.7.4. Opto-isolated inputs state

`Main menu>Menu [Diagnostic]>[Hardware]>[Remote In]`

Displays the present state of the opto-isolated inputs 1 - 9, A - C. The value [0] means the input is not actuated and the value [1] means the input is actuated (pulled to ground).

9.7.5. Relay state

`Main menu>Menu [Diagnostic]>[Hardware]>[Relay]`

Displays the present state of the relay 1 - 11 (hex 1 to B). The value [0] means the relay is not actuated and the value [1] means the relay is actuated.

9.7.6. System error messages

`Main menu>Menu [Diagnostic]>Menu [Messages]`

This submenu can be used to show the system related [Error] messages and to [clear messages] from the unit memory. The entry [System] has no function.

```
Diagnostic | System              Error
Messages   | Clear messages               Back
```

9.7.7. Unit configuration

`Main menu>Menu [Diagnostic]>Menu [Configuration]`

This submenu shows the customer specific setting (customer name) and, if available, available options. However, options are better displayed in the General tab of Arcos Config and should be checked there.

```
Diagnostic | Customer: Name
CoderConfig| Opt.: ARI   Link   SPS   TR    Back
```

9.7.8. Unit functions without menu access

Not all of the C02$_{DSP}$ functions are available via menu / jogwheel. These functions can be accessed via the Arcos Config control software and / or MEC commands.

9.8. Cold start default values

The C0X$_{DSP}$ has a default data set, the DSIB. The data of the DSIB is non-volatile stored in an EEPROM and being maintained after a cold start. The DSIB can be overwritten by the user with the customized UECP command 2D,04,52,53,10,DS or in the Link protocol by the command 'copy' with the data included in this data set. When carrying out a cold start the encoder loads all data sets with the data from the DSIB.

Because a cold start erases contents like AF lists and RadioTexts, an error message is generated in the error menu. If configured with the Arcos Config software, a relay or a LED is actuated additionally. The cold start error can be reset by the LCD menu entry

"[Diagnostic]>[Messages]>[Clear Messages]" or by UECP command if the option SNMP is available.

On delivery of the encoder the DSIB has the following values:

PI	0xFFFF		MS	1 (music)
PS	" RDS PS "		PTY	0 (undefined)
DI	1 (stereo)		PTYN	"RDS PTYN"
TA	Off		PIN	0x0000
TP	On		Linkage	0x0000

All other RDS specific data are not stored in an EEPROM and are loaded on a cold start with the default values:

AF	List with length 0 (E0 CD)
GS	0A
PSN List	17,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16

9.9. Signal parameters

The parameter which affect the output signal are non-volatile stored in an EEPROM and do not get lost by a cold start. On delivery of the device the following values are usually set:

Reference Table	1
RDS Pilot Phase	0°
RDS Level	219 mVpp
VRF Level	382mVpp
RDS	True (RDS on)
BK (ARI area identification signal)	0
VRF	False
VRF Phase	True
DK (ARI traffic announcement indication)	False

10. Interfaces

The RDS encoder C02$_{DSP}$ and C04$_{DSP}$ are equipped with several interfaces for the input and output of signals. All units support the UECP protocol V6.0. C02$_{DSP}$ and C04$_{DSP}$ optionally support the Link protocol (according to ARD specification sheet).

10.1. Serial RS-232 interfaces

> **HINWEIS**: To connect a computer to a serial interface of the C0x$_{DSP}$ it is necessary to use a serial cross-link cable!

10.1.1. Front serial interface [RS-232]

The front panel provides an RS-232 interface as a 9 pole male D-Sub connector. This interface is used for the serial connection to a computer with installed C0x$_{DSP}$ configuration software (e.g. Arcos Config). The interface uses the UECP protocol.

10.1.2. Rear panel serial interfaces [DTE1], [DTE2], [DTE3]

The rear panel provides three RS-232 interfaces as 9 pole male D-Sub connectors.

10.1.3. [Service] interface

This interface is only for servicing purposes. No data or setup communication possible.

10.1.4. Pin assignment of the serial interfaces

The figure "RS232 interface pin assignment" shows the pin assignment of the serial RS-232 interfaces. The interfaces do provide all handshake signals.

Configuration of the serial interfaces

When configuring the serial interfaces it has to be distinguished between a warm start and a cold start. Furthermore there are customized settings, which influence the behavior of the serial interfaces. The following tables describe the possible combinations. If there is no entry under warm start, the setting before carrying out the warm start will remain for the interface.
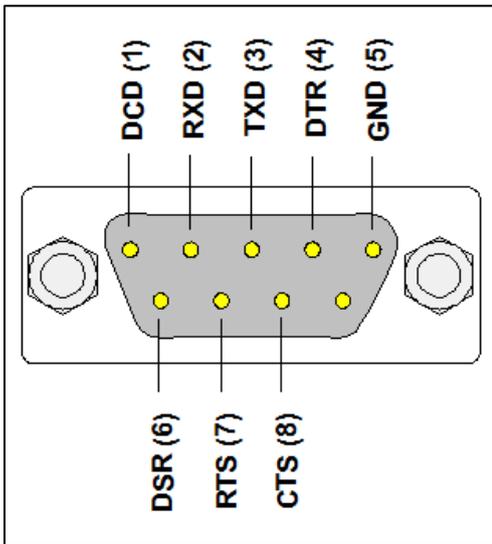
Figure 3: RS232 interface pin assignment

Default settings of the RS-232 interfaces (depends on options/customer)

C02$_{DSP}$/C04$_{DSP}$:

Standard configuration with UECP protocol:

interface	cold start	warm start
DTE1	9600 Baud UECP (EBU)	
DTE2	9600 Baud UECP (EBU)	
DTE3	9600 Baud UECP (EBU)	
FRONT	9600 Baud UECP (EBU)	

Configuration with UECP and Link protocol:

interface	cold start	warm start
DTE1	9600 Baud Link	
DTE2	9600 Baud Link	
DTE3	9600 Baud UECP (EBU)	
FRONT	2400 Baud UECP (EBU)	

Customized configuration ORF:

interface	cold start	warm start
DTE1	9600 Baud Link	
DTE2	9600 Baud Link	
DTE3	9600 Baud UECP (EBU)	
FRONT	9600 Baud UECP (EBU)	9600 Baud UECP (EBU)

Customized configuration Media Broadcast:

interface	cold start	warm start
DTE1	2400 Baud UECP (EBU)	
DTE2	9600 Baud UECP (EBU)	
DTE3	9600 Baud UECP (EBU)	9600 Baud UECP (EBU)
FRONT	9600 Baud UECP (EBU)	

10.2. IP network interface

The C02$_{DSP}$ (standard) and the C04$_{DSP}$ (optional) have a 10/100 MBit full duplex TCP/IP interface* [10/100-Base-T]. Use a shielded RJ 45 patch cable to connect the unit to the network.

* Not applicable for units without TCP/IP module.

10.3. BNC connectors

In the following chapters the BNC connectors are explained.

10.3.1. Front Panel

C02$_{DSP}$ and C04$_{DSP}$ are equipped with a BNC connector on the front panel. This connector [57 kHz + MPX] provides an RDS monitoring output. This output provides the RDS signal if just the pilot signal is provided to the unit. Alternatively the output provides the MPX + RDS signal if the MPX signal is provided to the unit.

10.3.2. Rear panel of C02/C04$_{DSP}$

[MPX-Input1] and [MPX-Input2]

At this input it is possible to feed in either:

- a pilot signal (square wave signal with TTL level or a sine signal)

- an MPX signal including the pilot, but without the 57 kHz signal (RDS).

It is possible to switch between the input to be used by menu (only C02$_{DSP}$) or by manufacturer specified commands (see page 38).

NOTE: When using the MPX-bypass and in case of AC power loss the signal from the active MPX input is switched to the RDS outputs! (Older hardware versions allow only a bypass from MPX input 1 to the RDS outputs.)

[RDS Output1] + [RDS Output2]

The RDS outputs 1+2 are the 57 kHz (+MPX) operational outputs. These outputs provide either just the generated RDS signal (bypass/summation off) as recommended for summation inside a stereo generator or the combination of a fed in MPX signal and the RDS/ARI signal (bypass/summation on) for the modulation of a transmitter.

Relay/Opto-isolated inputs connectors

[Relay Output]

C02DSP and C04DSP are equipped with 8 floating SPST (single pole single throw) relay contacts (A & B) which are normally open and three SPDT (single pole double throw) relay contacts which switch the contact A between contact B and contact C (connected to A if relay is not actuated). It is possible to assign functions to the individual relay; please see section 13.1 "Relay functions" on page 60 for details).
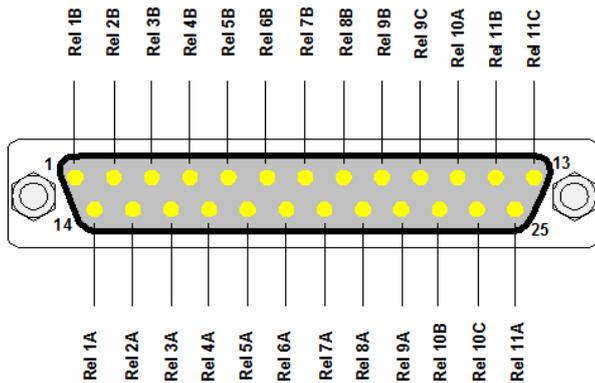
Figure 4: D-Sub 25 pole male connector (rear panel view)

[Optical Coupler Input]

C02$_{DSP}$ and C04$_{DSP}$ are equipped with 12 non-floating opto-isolated inputs. It is possible to assign functions to the individual opto-isolated input. See section "opto-isolated input functions" on page 53 for details.
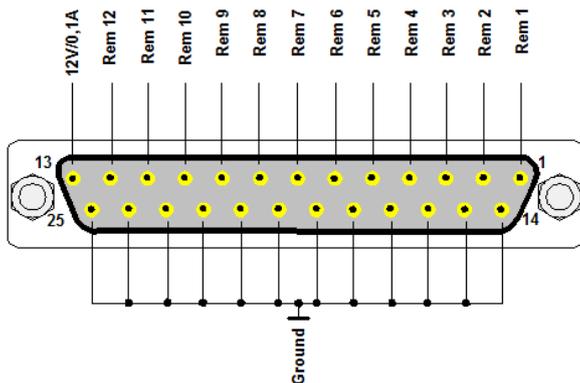
Figure 5: D-Sub 25 pole female connector (rear panel view)

10.4. Symmetrical outputs

C02$_{DSP}$ and C04$_{DSP}$ are delivered with asymmetrical outputs by default. It is possible to configure the RDS outputs to work symmetrical. This can be done with jumper settings on the main board. Please note that symmetric connectors have to be installed for this operation.

10.5. Jumper for symmetric RDS outputs and MPX bypass setting

The following only applies to hardware revisions of the main board of below V3.0, please contact us for instructions on how to modify your main board for V3.0 and above.

The main board inside the unit has jumper connectors, which set the RDS output mode to symmetrical or asymmetrical. Additionally the MPX bypass availability can be activated or deactivated. The following combinations are possible:

JP7   JP3   JP1   JP4   JP5
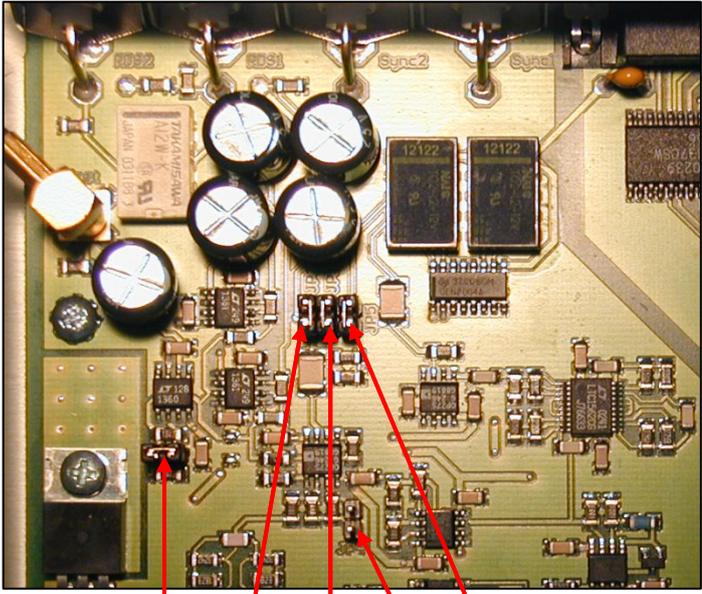
JP4 open	Rear RDS outputs work asymmetrical
JP4 closed	Rear RDS outputs work symmetrical
JP7 open	Front RDS monitor output works symmetrical
JP7 closed	Front RDS monitor output works asymmetrical
JP1/JP3/JP5 open	MPX-Bypass not available
JP1/JP3/JP5 closed	MPX-Bypass available (only for asymmetrical use!)

⚠ WARNING

⚠	Disconnect the supply cable from mains before you are going to open the unit.

CAUTION

Take actions against an electrostatic discharge (ESD) before you are going to open the unit.

ⓘ	**NOTE**: The RDS monitoring output on the front panel provides the correct level only if configured to the same mode as the rear RDS outputs (symmetrical or asymmetrical).

11. Interface functions / protocols

11.1. UECP protocol V6.0

General:
8 datasets (DSN) are available.
1024 site addresses and 64 encoder addresses are adjustable.

Implementing individual commands:

MEC 0A (RadioText)
Eight RadioTexts per data set are allowed.

MEC 13 (alternative frequencies)
MEL <= 29 (dec0). (Start-Location + 0xEn + 25 Frequencies + Terminator)
The Start-Location is allowed to accept 0x0000 or 0xffff values only.
0x0000 deletes the existing lists
0xffff adds the list to the existing
The Terminator is necessary in principle
An AF-list with the length 1 (terminator only) deletes the existing AF-lists
Only 70 AF-lists per data set are allowed

MEC 2D (manufacturer's specific command)
MEL >= 3 (message element data length - value needs to be adjusted if message length can vary
- e.g. at transparent mode.)
The Manufacturer Designation is „RS" (hex 52 53, dec. 82 83)

MEC 30 (TMC)
If the Buffer Configuration = 11 (bin) is being used, the data are transmitted at the mentioned frequency in the bits 4..1.
The frequency that is indicated in the bits 4..1 can be 0 (endless transmission).
Data with finite transmission are being sent contiguously. Data with set Flag "Extremely Urgent" are being sent immediately and continuously.

MEC 3C (baud rate)
The maximum baud rate is 38400
The minimum baud rate is 1200

MEC 17/0A (RT)
Instead of the data byte, which among other things includes the buffer configuration in the SET command, the buffer number is transmitted in the request command.

MEC 17/13 (AF)
The start location is used as a list index (buffer number). If the requested AF list is empty, the returned list contains only the terminator.

MEC 17/23 (site address)
The individual addresses are being sent in each case as separate UECP-frames. A list with the address 0x000 is send as a final list (a common address, valid for any encoder). This selection of readout was made because not all addresses may fit into a UECP-Frame.

MEC 17/27 (encoder address)
The last address in the list is always 0x00, which is defined for all encoders. If no further address is existent, the 0x00 address is returned only.

MEC 31 (EPP transmitter information)
The last data byte is ignored but has to be sent.

11.2. Manufacturer Specified Commands of the C0x$_{DSP}$

Function	UECP-command
Save DSIB (Default Dataset)	2D,04,52,53,10,DS (DS=0, 1..8)
MPX Bypass ON	2D,04,52,53,01,01
MPX Bypass OFF	2D,04,52,53,01,00
Activate MPX Input 1	2D,04,52,53,02,01
Activate MPX Input 2	2D,04,52,53,02,02 Note: Please use these manufacturer specified commands to select the activated MPX input. The UECP MEC command "1D" just selects the reference table.
Warm start	2D,03,52,53,FE
Cold start	2D,03,52,53,FF
Cold start without reset of the TCP/IP network module (NetPC)	2D,03,52,53,FD
Erase cold start warning (Function requires the option SNMP)	2D,04,52,53,85,04
Switch interface protocol to Link* or UECP (*Link only if option "Link" is installed)	2D,05,52,53,*port,protocol* *port*: 01=DTE1;02=DTE2;03=DTE3; 04=Front *protocol*: 00=UECP; 01=LINK
Check interface protocol setting (see port details above)	2D,04,52,53,*port* Response: 2D,05,52,53,06,*port,protocol* *port*: 01=DTE1;02=DTE2;03=DTE3; 04=Front *protocol*: 00=UECP; 01=LINK
Assign a reference table to an MPX input.	2D,05,52,53,09,*MPXinput,ref.table* *MPX input*: 01=input 1; 02=input 2 *ref.table*: 01 to 06 = reference table 1 to 6
Readout reference table to MPX input assignment.	2D,03,52,53,0A Response: 2D,05,52,53,0A,*ref.table for input1,ref.table for input 2* *ref.table for input 1/2*: 01 to 06 = reference table 1 to 6

Set SNTP* address	2D,07,52,53,CD,*xx,xx,xx,xx* *xx*=IP address
Readout SNTP* address	2D,03,52,53,CC Response: 2D,07,52,53,CC,*xx,xx,xx,xx*
* Requires option SNMP	
Set TCP/IP port	2D,05,52,53,CF,*portH,portL* e.g. for 6666 (hex1A0A): *portH*=1A *portL*=0A
Readout TCP/IP port	2D,03,52,53,CE Response: 2D,06,52,53,CE,02,*portH,portL*

NOTE: Commands do not send a response if not otherwise stated.

11.3. Link protocol

A manufacturer specific command can be used to set the protocol (UECP or Link*) of the serial interfaces [DTE1] to [DTE3] and [Front] of the C02/C04$_{DSP}$.

* Requires option LINK, LINK is discontinued in versions V2.x (and higher)

11.3.1. Implementation of individual commands

EON AF method B:
The available C02/C04$_{DSP}$ version does not support the input of AM frequencies, neither in the UECP nor in the Link protocol.

Linkage:
The group 14A, AC12 of the linkage is send if LN (Bit 0..12) is set. The LA und EG Bit do not influence the transmission of AC12. In order to set LA, EG or LN in the Main PSN only, the PI in the EON command is allowed to be the PI in the Tuned Network; all other EON commands with PI of the tuned Network are not being carried out.

Copy:
The command copy (short information character c) copies PI, PIN, PS, TA, TP, MS, DI, PTY, PTYN and the Linkage Information of the given data set into the start up data set (DSIB). The data of the DSIB are non-volatile stored in the EEPROM. The data can be used for initialization of the data sets after a cold start of the C02/C04$_{DSP}$.

Priority status:
Selection of the interface: 00 operates all ports, 01 operates the front interface, 02 operates all interfaces on the rear side (DTE1, DTE2 and DTE3), 2A operates interface DTE1, 2B operates DTE2 and 2C DTE3. The function of the inputs can be programmed variably. As this results in a possible overriding of the set priority status, no priority status can be set for the switching inputs. The priority status can only be set through the front interface. The front interface cannot be locked.

Alarm functions:

The alarm function according to the ARD performance specification V3.3 is not implemented in the C04$_{DSP}$ since there is no possibility for adjusting the functionality on the front panel of the C04$_{DSP}$.

Non-implemented commands:

FFG

The commands with the short information character Hz, 4z and Kz are not implemented. Therefore groups 1B, 4A, and 4B cannot be filled with any data.

11.4. ZIDEM

The function ZIDEM* (IH, Inhouse data monitoring), that the C0x encoder optionally supports, is configured and operated solely via the Arcos Config PC software ≥V2.00.

* Requires option ZIDEM

11.4.1. SNMP - Simple Network Management Protocol

The encoder optionally supports SNMP*. SNMP can be used to read out several parameters and to setup some parameters via the IP network. In case of a coder warning, the encoder can generate specific SNMP events or SNMP traps.

> **NOTE**: An SNMP network access is only possible if the community strings of the device are configured (see p.38). It is also necessary that the accessing SNMP manager tool is set to the same community strings that are used in the device.

* Option SNMP required

Parameters that can be accessed via SNMP:

Parameter	Readable via SNMP	Configurable via SNMP
IP address	yes	
Netmask	yes	
Gateway IP	yes	
SNMP IP 1	yes	
SNMP IP 2	yes	
SNTP IP	yes	
SNTP Update Interval	yes	yes*
SNMP Event Priority	yes	yes
SNMP Event Enable	yes	yes
SNMP Trap Priority	yes	yes
SNMP Trap Enable	yes	yes
SNMP sysContact (mib-2/system)	yes	yes
SNMP sysName (mib-2/system)	yes	yes
SNMP sysLocation (mib-2/system)	yes	yes

* Note: Reset (warm start) the device for the changes to take effect.

For further information about the possibilities the encoder does offer via SNMP consult the corresponding MIB file, which you should find on the CD that came with the encoder.

11.4.2. Sending of SNMP events

In case of a device re-start, all activated SNMP events are sent as status information. The encoder is able to control predefined processes. In case of a warning, a warning specific SNMP event is being generated as a warning message. This SNMP event will then be transmitted via the IP connection to a specified SNMP management system. This system, equipped with an SNMP-Management-Tool and the specific 2wcom C0x MIB file for processing the SNMP events, is being able to monitor multiple encoders.

The configuration of warning conditions, as well as reading and deleting existing warning-messages can be carried out via ARCOS Config or via special UECP-commands.

Additionally it is possible to enable or disable specific SNMP events via SNMP and to assign different priorities to the SNMP events via SNMP.

> **i** **NOTE**: For sending SNMP events, it is necessary to ensure that the required events are enabled in the encoder itself (either via ARCOS Config or via UECP MEC command) and also via SNMP (see object c02c04EventEnable - 1.3.6.1.4.1.21529.1.1.10.23.7).

Possible SNMP events:

SNMP Event	Triggering event
coldStart	Cold start
warmStart	Warm start
dspEvent	>90 ms DSP inactivity
rdsEvent	RDS signal off / returned
pilotEvent	Pilot signal off / returned
portTimeoutEvent	Configured interface port timeout exceeded. The affected port (DTE1, DTE2, DTE3, Front) is given in the SNMP event.
odaTimepoutEvent	Configured ODA data feed timeout exceeded. The effected ODA group (e.g. 12A) is given in the SNMP event.
ipTimeoutEvent[1]	Configured IP port timeout exceeded. The affected IP port is given in the SNMP event.
optoEvent[2]	An opto isolated input changed its state. The affected input and its current state is given in the SNMP event. This event is only generated, if the corresponding input is configured to generate a SNMP event (Page Hardware Setup / Optos in ARCOS Config). Using ARCOS Config you can even configure for each input an individual message, that will get sent with the SNMP event (Page Hardware Setup / SNMP).
taChangedEvent[1]	TA bit in MainPSN of current dataset changed its state
taEonChangedEvent[1]	TA bit in EON-PSN of current dataset changed its state
tpChangedEvent[1]	TP bit in MainPSN of current dataset changed its state
msChangedEvent[1]	MS bit in MainPSN of current dataset changed its state

ptyChangedEvent[1]	PTY in MainPSN of current dataset changed its state
ctChangedEvent[1]	CT enabled/disabled in encoder
datasetChangedEvent[1]	The number of the current dataset changed
vrfChangedEvent[1]	VRF/ARI enabled/disabled in encoder
refInputChangedEvent[1]	The number of the current RDS reference table changed

[1] firmware V3.22 or higher and TCP/IP module firmware V4.03 or higher required

[2] firmware V3.30 or higher and TCP/IP module firmware V4.10 or higher required

11.4.3. Transfer of warnings

Warnings and commands for configuring the warning behavior of the C0x$_{DSP}$ are being transmitted via UECP MEC-commands.

MEC – commands:
Reading a single warning:
MEC 0x85

MEC	0x2D	Response:	
MEL	0x05	2D,0A,52,53,85,03,xx,Year,Month,Day,Hour,Minute	
Man.MEC1	0x52	xx=Warning number, see table on p. 36	
Man.MEC2	0x53		
Command1	0x85	or	
Command2	0x03	2D,05,52,53,85,03,00	
Warning No.	0x00-0xFF	(if specified warning does not exist)	

Deleting the list of occurred errors:
MEC 0x85

MEC	0x2D
MEL	0x04
Man.MEC1	0x52
Man.MEC2	0x53
Command1	0x85
Command2	0x04

11.4.4. Configuration of the warning behaviour

It can be configured to send or not to send an SNMP event/trap if a warning condition occurs. The warning configuration is being stored in the EEPROM of the encoder.
Upon delivery, a standard configuration is already being stored in the EEPROM.

Reading warning configuration
(which errors are triggering warnings):
MEC 0x85

MEC	0x2D
MEL	0x04
Man.MEC1	0x52
Man.MEC2	0x53
Command1	0x85
Command2	0x01

Set warning configuration
(which errors are triggering warnings):
MEC 0x85

MEC	0x2D
MEL	0x06
Man.MEC1	0x52
Man.MEC2	0x53
Command1	0x85
Command2	0x02
Warning byte 1	0x00-0xFF
Warning byte 2	0x00-0xFF

Warning bits are related to the two warning bytes as follows:
(Bits are read from right to left, i.e. "coldStart" is the first bit from the right of the second warning byte.)

SNMP-Event	Bit
coldStart	= 0
warmStart	= 1
dspEvent	= 2
rdsEvent	= 3
pilotEvent	= 4
portTimeoutEvent (DTE1)	= 5
portTimeoutEvent (DTE2)	= 6
portTimeoutEvent (DTE3)	= 7
portTimeoutEvent (FRONT)	= 8
Reserved	= 9
odaTimeoutEvent	=10
ipTimeoutEvent	=11
Reserved	=12-15

Example: To enable all available SNMP events / traps, you can send the following MEC command to the device: 2D,06,52,53,85,02,**0D**,**FF**

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binär	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1
Hex	**0D**								**FF**							

Please note that these settings can also be performed via Arcos Config. The warning settings that can be accessed via SNMP are independent from the settings above.

11.5. Storing warning messages

The last 256 warning messages are stored in the non-volatile EEPROM of the RDS encoder.
A cold start of the encoder will erase all warning-messages.
Stored warning-messages can either be readout with ARCOS Config, with MEC-commands or on the display of the encoder.

Menu path: **[Diagnostic]>[Messages]>[Error]**

11.5.1. User interface

There are three ways for the user to readout warning-messages.

- Displaying SNMP events directly by using an PC SNMP-Manager-Tool
- On the display of the encoder
  (Error-messages are stored and are displayed as text messages)

```
0:23.10.2009 11:50->Warmstart
1:23.10.2009 11:55->Port_Timeout DTE1
```

- By using Arcos Config (Menu>Encoder>Show Error Protocol…).

11.5.2. Configuration of the SNMP Manager(s)

Using ARCOS Config you can configure two independent SNMP manager addresses, which may receive the SNMP events generated by the encoder.

11.6. SNMP Community Strings configuration

The SNMP Community Strings are "Passwords" for the network access to the SNMP functions of the device. The device supports two "Read Community" strings for read-only access, as well as two "Write Community" strings for full access. If the device is still in factory condition, these need to be configured to the desired community strings, as used in your SNMP management tool.

The configuration of the SNMP community strings can either be done via ARCOS Config (Page Hardware Setup / SNMP) or via a terminal program with a serial RS-232 connection to the "Service" interface of the device (9600 baud, 8N1).

Display the configuration:	Enter the command "snmp info" in the terminal program to see the present configuration of the community strings. The factory settings are "public" (Read) and "private" (Write).
Change the configuration:	Use the following command in the terminal program for configuration:

Syntax: set community string [user]=string

user = R1 (1. Read Community)

R2 (2. Read Community)

W1 (1. Write Community)

W2 (2. Write Community)

string = The desired community string (alphabetic characters, numbers, no special characters).

Example: „set community string[R1]=public"

11.6.1. Transparent mode

The RDS encoder optionally supports the transparent mode for the transmission of raw groups (Hex-data framed in UECP-commands) in the RDS-data stream.

The transparent mode can be activated instead of the standard encoder operation.
While the transparent mode is active, the normal encoder operation will be deactivated. Raw data will be forwarded to the encoder and transmitted unchanged (transparently) along with the RDS-data stream. So it is e.g. possible to send formerly recorded RDS-data in the exact same sequence again.

11.6.2. Possible modes (circular buffer and simple mode)

There are two modes in the transparent mode, one is the simple mode and the next is the circular buffer mode.

Simple mode
In this mode, the received data will be transmitted once and will not be available later on anymore. Thus, data needs to be supplied constantly. In case there are no more group data available in the memory to be sent, there is a standard group sequence available for transmission, preventing RDS-data stream interruptions.

Circular buffer
When circular buffer mode is used, the data only needs to be received once and will then be transmitted repeatedly. Note that the data have to be within the encoder already before this mode is activated. After the last group is sent out, the encoder will then start with the first group again. While the circular buffer mode is active, data must not be added! If data is added nonetheless, the circular buffer mode is halted, old buffer data will be deleted and replaced by the new data. After this the circular buffer mode has to be reactivated again. While the circular buffer mode is inactive, the standard group sequence will be transmitted repeatedly.

Burst transmission
It is possible to transmit group data-bursts in both modes. With a special MEC command it is possible to send group data to the encoder to be sent out immediately. Up to 20 group data blocks can be stored in the encoder for burst transmission. As long as there are burst group data

available, it will be sent out and the standard group data transmission is suspended until all burst group data are being sent.

Memory for group data

For the application of the transparent mode three different memory areas are available: the main memory, burst-memory, and the reserve memory.

Main memory

Main memory is used to store group data which are transferred using the manufacturer specified "D1" MEC-command. A total of 1000 group data blocks can be stored. These group data blocks will be transmitted when the encoder is running in standard transparent mode, i.e. if no burst-group data do exist and the circular buffer mode is not halted. The main memory can be used in the simple mode as well as in the circular buffer mode.

Burst memory

Burst-memory is used to store group data which are to be transmitted immediately. If there are any group data in the burst-memory, these data will be transmitted first in front of other group data from different memory areas. Up to 20 group data blocks can be stored in the burst-memory and it only works in the simple mode, i.e. data from burst-memory will only be sent once.

Reserve memory

The reserve memory contains 20 groups of standard sequences and is operating in the circular buffer mode while transmitting the data repeatedly. The encoder is in the transparent mode and there are no additional group data available in the main-memory and burst-memory. Now the reserve memory is being used to transmit these stored group sequences of data instead.

The following figure illustrates the flow of data processing in the transparent mode:
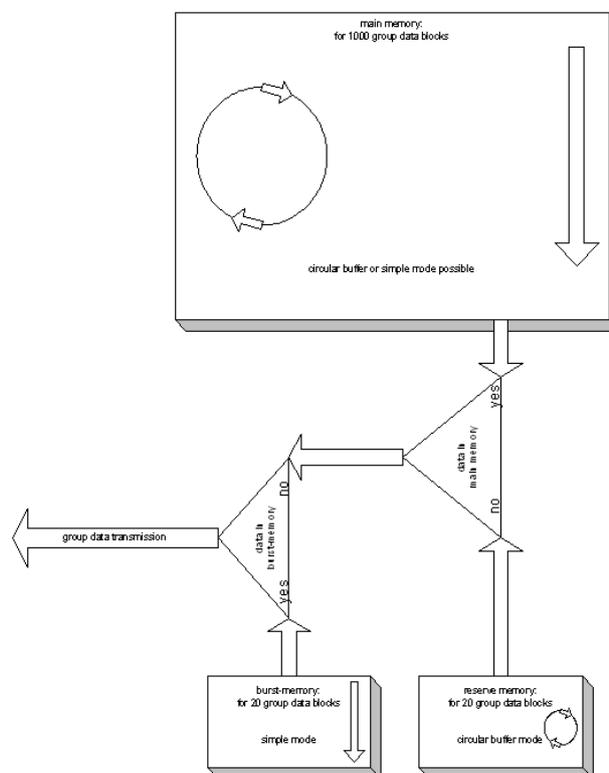
11.6.3. MEC commands

To activate the transparent mode, the manufacturer specific MEC-command "D0" is used.

MEC	0x2D
MEL	0x04
Man.MEC1	0x52
Man.MEC2	0x53
Command	0xD0
Transparent mode	0x00 – 0x02

There are three possible settings:
- terminate transparent mode = 0
- start transparent mode (in simple mode) = 1
- start transparent mode (in circular buffer mode) = 2

The encoder will return to standard operation, when the transparent mode is terminated.

Transmission of standard group data:

MEC	0x2D
MEL	0x0C - 0xF4
Man.MEC1	0x52
Man.MEC2	0x53
Command	0xD1
Group quantity	0x01 – 0x1E
First group data part	0x00 – 0xFF
...	...
Last group data part	0x00 – 0xFF

To transmit group data to the encoder, the manufacturer specific MEC-command "D1" is used. With this MEC-command 1 to 30 group data blocks can be transmitted. Each group data block consists out of 8 bytes.

The MEL and the Group Quantity needs to be adjusted depending on the message element length and the quantity of groups.

Examples:
2D,**0C**,52,53,D1,**01**,E1,13,E5,5D,18,00,E2,11
(transmission of one group)

2D,**14**,52,53,D1,**02**,E1,13,E5,5D,18,00,E2,11,E2,14,E6,5E,19,01,E3,12
(transmission of two groups)

The encoder will respond to the transmitted group data either with an ACK or with NACK. If there is sufficient space for the group data, an ACK is sent. Otherwise the encoder responds with a NACK.

Transmission of burst group data:

MEC	0x2D
MEL	0x0C - 0xF4
Man.MEC1	0x52
Man.MEC2	0x53
Command	0xD2
Group quantity	0x01 – 0xF4
First group data part	0x00 – 0xFF
...	...
Last group data part	0x00 – 0xFF

To transmit burst-group data to the encoder, the manufacturer specific MEC-command "D2" is used. For further explanation on burst-group data see section "Burst transmission" on page 45.

11.6.4. Transmission of reserve group data

To transmit reserve-group data to the encoder, the manufacturer specific MEC-command "D3" is used. The MEL and the Group Quantity needs to be adjusted depending on the message element length and the quantity of groups. For further explanation on reserve-group data see section "Reserve memory" on page 45).

MEC	0x2D
MEL	0x0C - 0xF4
Man.MEC1	0x52
Man.MEC2	0x53
Command	0xD3
Group quantity	0x01 – 0xF4
First part of group data	0x00 – 0xFF
...	...
Last part of group data	0x00 – 0xFF

Examples:
Simple mode: In order to send data to the encoder and to have it transmitted just once, simple mode is used. The following is possible:

Simple transparent mode can be activated or the data to be transmitted can be sent to the encoder.

If the data were sent first and the simple mode was activated thereafter, the encoder begins to transmit the group data right away.

11.6.5. Example: Simple mode

Simple mode: In order to send data to the encoder and to have it transmitted just once, simple mode is used. The following is possible:

Simple transparent mode can be activated or the data to be transmitted can be sent to the encoder.

If the data were sent first and the simple mode was activated thereafter, the encoder begins to transmit the group data right away.

If simple transparent mode was activated first and data for transmission were sent later, the encoder will send reserve data for a transition period. If there are no reserve data available yet, fixed implemented standard group data will be transmitted instead.

As soon as group data are being forwarded to the encoder, they will be transmitted. In case all group data have been transmitted and no more group data are being forwarded to the encoder, reserve data will be transmitted again.

Burst-group data can be transmitted anytime independent from the availability of group data or reserve group data. Burst-group data send to the encoder will always be transmitted immediately.

11.6.6. Example: Circle buffer mode

In order to send data to the encoder once and then have it transmitted repeatedly, circular buffer mode is used. The following is possible:

In the circular buffer mode, group data have to be sent to the encoder prior use.

After group data have been sent, the circular buffer transparent mode will be activated. Group data will be periodically and repeatedly transmitted until this mode is terminated.

If new group data are being sent to the encoder while the transparent mode is active, old group data will be deleted and the circular buffer transparent mode will be halted. Now, new group data can be sent until the circular buffer mode is activated again. While inactive, reserve group data will be transmitted.

Burst-group data can be transmitted independent of the availability of group data or reserve group data, active or inactive circular buffer transparent mode at any time. Burst-group data being sent to the encoder will be transmitted always immediately.

11.7. ODA - Open Data Applications

In order to use RDS for non-specific applications, open data applications can be used (if option ODA is installed). By means of open data application-groups, any data can be sent to an application. For this application, the integrated free format buffer will be used. Data will be sent to the encoder by means of UECP-commands and stored with all the necessary additional information in the corresponding sending-queues. Data stored in these sending-queues will be transmitted via their corresponding ODA groups later on. To preserve the flexibility of ODA applications, commitment of at present transmitted ODA applications takes place "On Air". RDS-Receivers will receive the necessary additional information via the 3A group.

11.7.1. Procedure

An 0xFFFF AID (Application Identification) number is assigned to each application. By an AID, an application is addressed. Subsequently the AID is then assigned to a group wherein the actual transmission of the data takes place. The 3A group will inform a receiver, which AID is addressing which group. Once the process of assigning an application to an AID, assigning an AID to a group and informing the receiver is finished, data can be transmitted via this group. A receiver can now assign data to a specific application and forward it.

To accommodate a wide spectrum of applications, a new group sequence mechanism has been implemented. One option is to transmit ODA-group data in burst-mode, another option is to use the special "Spinning Wheel"-mode.

In addition to that, data sent to the encoder can be assigned to a certain priority and the encoder will transmit the data based on the order of priority.

11.7.2. Dispatch modes

Transmission of data that has been sent to the encoder can be achieved as follows:

11.7.2.1. Standard group sequence

The standard group sequence can be used. The data will then be sent according to the group sequence order.

11.7.2.2. Burst:

In the burst-mode data can be transmitted similar to 14B and 15B groups as bursts. That is, independent from the standard group sequence, group data of the same group will be transmitted

consecutively. It can be configured how often a group will be transmitted consecutively and how many other groups have to be transmitted between two burst-data transmissions of the same group.

11.7.2.3. Spinning wheel

The Spinning Wheel mode allows data to be transmitted to a specific application at specific times. It is possible to divide a minute into periods where data can be sent and where data may not be sent, in an alternating scheme. Period lengths can be individually defined for each application. It is also possible to define an offset between the beginning of a minute and the first period.

11.7.3. Priorities

- Groups 1A and 4A, as well as paging-groups do have a higher priority in general.

- ODA groups can be used with "normal", "extremely urgent", and "immediately" priorities, by adding a priority flag when sending the group data to the encoder.

  Normal mode: sent group data will be positioned at the end of the sending-queue of the corresponding Free Format Buffer

  Very urgent mode: Sent group data will be positioned at the beginning of the sending-queue and will be transmitted as soon as the corresponding ODA group is being sent.

  Immediately mode: The specified group sequence will be neglected, so the group will be transmitted immediately. Note that groups 1A, 4A and other privileged groups still have higher priority.

- A special priority list can be made for ODA groups (including groups 14B and 15B). This priority list will be used whenever data with the status "Immediately" are existent.

- If ODA is used, no FFG (Free Format Groups) are transmitted.

11.7.4. Sending and processing ODA data

When sending ODA data to the encoder the following additional information is sent, in order to specify how the data has to be processed:

- Priority-mode (normal, very urgent, immediately)
- Buffer-mode (cyclic or single transmission)
- Send-mode (normal, burst or "Spinning Wheel")

Depending on the mode, forwarded data will be processed and transmitted differently. The following figure illustrates how the forwarded data are being processed in the encoder:
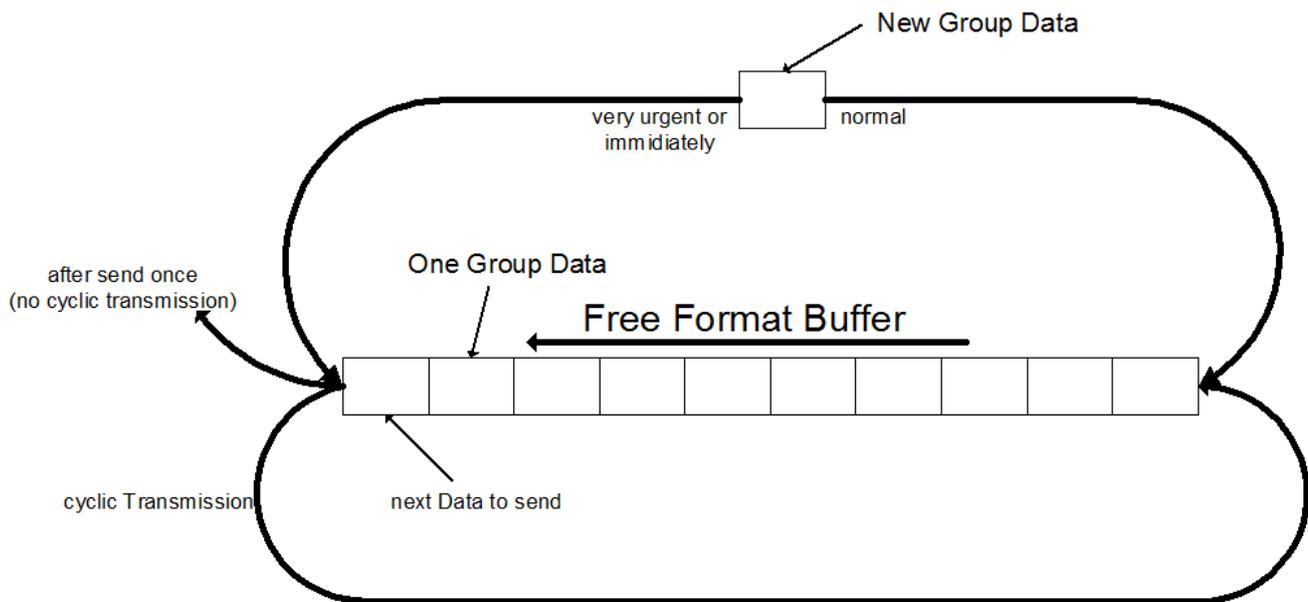
11.8. IP multicast

Starting with NetPC firmware V4.11, the encoder does support IP multicast. In contrast to unicast communications, where messages are sent from one source device to one recipient device, multicast supports the ability to have one device sending a message to a set of recipients.

Special IP addressing must be used for multicasting. These multicast addresses identify not single devices but rather multicast groups of devices that listen for certain datagrams sent to them. A complete range of IPv4 addresses is reserved for multicast addresses:

224.0.0.0 to 239.255.255.255

Using ARCOS Config, the configuration tool for the 2wcom RDS encoders, it is possible to enter up to 5 IP multicast addresses. The encoder will automatically join these multicast groups using the Internet Group Management Protocol IGMP.

The corresponding configuration page in ARCOS Config can be found under "Encoder→Hardware Setup→Connection→Multicast". Note that the multicast configuration with ARCOS Config can only be done if the encoder is connected via TCP/IP.

11.9. IP filtering

IP filtering is simply a mechanism that decides which types of IP datagrams will be processed normally and which will be discarded meaning the datagram will be deleted and completely ignored, as if it had never been received.
The IP filtering in the encoder, which is supported starting with NetPC firmware V4.12, is applied to the IP source address restricting the access to the encoder to certain source IPs.
Please note, that if your connection to the encoder passes one or more routers, it's likely that the encoder will not "see" your real source IP address, but the address of the router.

To check the IP the encoder is "seeing" when a connection is established to the encoder, you may connect to the service port of the encoder (next to the RJ-45 jack for the 10/100MBit IP connection), using a terminal program like HyperTerminal. The communication settings are 9600 baud, 8N1, no handshake. To check for correct communication settings you may enter e.g. the command "version" followed by [Enter], which should print out some version information for the NetPC firmware.

On connection establishment you should get a message like the following:

`Port 8000 connected to client `**`192.168.14.218`**`; remote port 55118`

The client IP (marked in bold) is the one which may be used for IP filtering. ARCOS Config allows entering up to 5 IP addresses for IP filtering – only datagrams with one of that source IPs will be accepted by the encoder. The corresponding configuration page in ARCOS Config can be found under "Encoder→Hardware Setup→Connection→IP Filtering".

12. Device software functions

The RDS encoders C02$_{DSP}$ and C04$_{DSP}$ come with several additional software features, some of which are optional. The following features are available:

12.1. Scrolling PS

The Scrolling PS function (optional), allows for a PS greater than 8 characters which is then shifted through the display according to the users preferences. This feature can be used by radio stations that want to use longer station names, i.e. "Vancouver 21 Radio Station West Ave", instead of an abbreviation, i.e. "V21RSWA". Also the Scrolling PS function can be used to display additional information, especially on radio equipment that doesn't support RadioText natively.

In order for Scrolling PS to work, the text needs to be more than 8 characters long, otherwise the standard PS will be used until text data in sufficient length is available.

Scrolling PS can be configured using Arcos Config and runs in two modes:

- Standard: PS is shifted by n charaters at each interval, i.e. in above example with 2 characters per step and a 1 second interval: starting with "Vancouve" at 0 seconds, PS changes to "ncouver " at 1 second to "ouver 21" at 2 seconds and so on.

- Smart: PS is shifted word wise, where possible, at each interval. If a word is longer than 8 characters the characters per step setting states the size of a chunk the word is broken down into, i.e. in above example with 5 characters per step and 1 second interval: starting with "Vanco" at 0 seconds, PS changes to "uver" at 1 second to "21 Radio" at 2 seconds "Station" at 3 seconds and "West Ave" at 4 seconds.

  Above example illustrates three rules that apply to smart scrolling:
  1) By design the last chunk of a broken down word is filled up with empty spaces, even if the next word would still fit into the 8 character boundary, i.e. "uver" instead of "uver 21" in above example.
  2) If two or more unabbreviated words fit into one 8 character string, they will be put out simultaneously, i.e. "21 Radio" or "West Ave" instead of "West" and "Ave" at next interval.
  3) In order to force two words to be interpreted as one, an underscore is used instead of space, i.e. "Now On_Air", forces smart scrolling to put out "Now" in one interval and "On Air" in the next, instead of "Now On" and "Air". Underscores will not show up on displays as they are not supported. If two or more words connected by underscores extend beyond 8 characters, they're split up according to 2).

The text for Scrolling PS is either derived from RadioText or from a separate text containing a maximum of 160 characters. Note that the separate text works closely with the automation interface function and will only be displayed for the duration set there. If the duration in the automation interface is set to 0 and the automation interface is not used, the separate text can be considered as static.

12.2. Automation Interface

The Automation Interface can be used to send dynamic data to the C02$_{DSP}$ and C04$_{DSP}$ encoders via a third party software or device. Mainly intended for radio studios to dynamically insert music information, i.e. song title and artist, to be put into RadioText, it can also be used for instance to toggle TA. Automation data can be sent via all RS232 serial interfaces that are configured with protocol [Terminal] or [Auto] or over Ethernet using the automation port.

Automation data is sent using commands that are transmitted in clear text (ASCII). Commands are executed sequentially, meaning the order in which commands are given can lead to different results. A command is executed by pressing the Enter key in case of manual input or by appending a line feed (0x0A) or carriage return (0x0D) character at the end of each command when using an external software or device.

There are several commands available, listed in the following table. Note that command processing is case sensitive. Commands are shown in between two apostrophes.

Command	Description
TITLE	Sets the title for the current audio playback Syntax: 'TITLE=All over my head'
ARTIST	Sets the artist for the current audio playback Syntax: 'ARTIST=Gene Davies'
DURATION	Sets the duration for which the current dynamic data is valid, before reverting back to standard values. There are three possible formats: Syntax 1: 'DURATION=00:01:30' (hours/minutes/seconds) Syntax 2: 'DURATION=01:30' (minutes/seconds) Syntax 3: 'DURATION=90' (seconds only)
STRINGn	Sets the value for one of three possible text strings Syntax: 'STRING1=You're listening to', 'STRING2= by ' and 'STRING3= on Hitz Radio'
FORMAT_RT	Sets the format of the dynamic RT Syntax: 'FORMAT_RT=STRING1+TITLE+STRING2+ARTIST+STRING3' results into: You're listening to All over my head by Gene Davies on Hitz Radio
FORMAT_DYNPS	Sets the format of the dynamic Scrolling PS Syntax: 'FORMAT_RT=STRING1+TITLE+STRING2+ARTIST+STRING3' results into: You're listening to All over my head by Gene Davies on Hitz Radio
AUTO_RT	Enable/Disable automatic dynamic RT generation when one of the FORMAT_RT components change, i.e. ARTIST

	Syntax: 'AUTO_RT=Y' to enable or 'AUTO_RT=N' to disable
AUTO_DYNPS	Enable/Disable automatic dynamic Scrolling PS generation when one of the FORMAT_DYNPS components change, i.e. ARTIST Syntax: 'AUTO_DYNPS=x' to enable or 'AUTO_DYNPS=N' to disable
DYNPS	Sets the value of the dynamic Scrolling PS data (up to 160 characters). Already existing separate text for Scrolling PS will be overwritten. Syntax: 'DYNPS=Hitz Station is now offering free music downloads'
DYNRT	Sets the value of the dynamic RT data, up to 64 characters are possible. Already existing dynamic data will be overwritten. Syntax: 'DYNRT=Hitz Station is now offering free music downloads'
DYNPS_DELAY	Time until dynamic Scrolling PS data is rendered ready for transmission. Each update to any component of FORMAT_DYNPS will reset the timer. This ensures that data can be transmitted completely prior to transmission. Syntax: 'DYNPS_DELAY=5' (range is from 1 to 30 seconds)
RT_DELAY	Time until dynamic RT data is rendered ready for transmission. Each update to any component of FORMAT_RT will reset the timer. This ensures that data can be transmitted completely prior to transmission. Syntax: 'RT_DELAY=5' (range is from 1 to 30 seconds)
RT	Sets the value of RT buffer 1, up to 64 characters are possible Syntax: 'RT=Now on Hitz Radio'
RTn	Sets the value of one of eight RT buffers, up to 64 characters are possible Syntax: 'RT1=We have a winner!', 'RT2=Please do not call anymore' use 'RT1=' through 'RT8=' to access each buffer Note: RT buffers can only be used sequentially, i.e. if RT1 to RT3 are in use, only RT1 to RT4 can be set, but not RT5 (this will produce an error message in the terminal)
TA	Sets TA bit or can be used to set TA for a given time Syntax: 'TA=ON' to enable, 'TA=OFF' to disable or 'TA=45' to set TA for 45 seconds (numbers in the range from 0 to 99 are possible).
PTY	Sets PTY Syntax: 'PTY=21' (sets PTY to 21, possible are all numbers from 0 to 31)
DS	Sets current data set Syntax: 'DS=3' (numbers range from 1 to 8, each corresponding

	with the data set with the same number)
AUTO_RTPLUS	Sets automatic RT+ tagging based on TITLE and ARTIST. Can be used for instance by RT+ capable devices to link to downloadable music, further information, music stores, etc. Syntax: 'AUTO_RTPLUS=Y' to enable or 'AUTO_RTPLUS=N' to disable
HELP	Shows a list of all automation commands Syntax: 'HELP'
STATUS	Shows a list of all current settings Syntax: 'STATUS'

To ease implementation into existing systems, the following commands can be given one up to 20 characters long alias each: STRING, ARTIST, TITLE, DURATION, TA=ON, TA=OFF, RT, DYNPS, DYNRT. To do this simply type the command followed by '/ALIAS=' and enter the new designator, i.e.: 'TA=ON/ALIAS=TAStart'. Now both 'TA=ON' and 'TAStart' can be used to activate TA. Others examples: 'ARTIST/ALIAS=Artiste' or 'TITLE/ALIAS=Titel'. Note that in case of the TA=ON and TA=OFF commands, the '=ON' and '=OFF' are part of the actual command, thus it is not possible to use 'TA/ALIAS=Traffic'. Aliases can also be configured using Arcos Config.

Basic examples for automation, with Scrolling PS active and RT used as source:

First of all, the STRING variables are set up and general settings are made:

'DS=1'
'RT=Hitz Radio'
'STRING1=You are listening to '
'STRING2= by '
'STRING3= on Hitz Radio'
'DURATION=120'
'FORMAT_RT=STRING1+TITLE+STRING2+ARTIST+STRING3'
'AUTO_RT=Y'
'RT_DELAY=3'
'FORMAT_DYNPS=STRING1+TITLE+STRING2+ARTIST+STRING3'
'AUTO_DYNPS=Y'
'DYNPS_DELAY=3'

This setup script sets the current data set to data set 1 and RT buffer 1 to "Hitz Radio". Whenever new ARTIST or TITLE data is send, it becomes active 3 seconds (RT and DYNPS_DELAY) after the last entry is made (to any variable in FORMAT_RT and FORMAT_DYNPS) and stays that way for 2 minutes (DURATION) before reverting back to showing RT buffer 1 as PS (Scrolling PS is set to use RT as source for PS). In these two minutes both PS and RT will be changed to "You are listening to TITLE by ARTIST on Hitz Radio", so that even older radio equipment that can only show PS and not RT data, have the full benefit of information that is sent.

Now all the studio operator for a music programme has to do is having his studio software update ARTIST and TITLE when new songs are started.

An example on how to fill in a traffic announcement would be:

'DYNRT=You are listening to traffic watch on Hitz Radio'
'DYNPS=You are listening to traffic watch on Hitz Radio'
'TA=ON'

Now the traffic announcements are made. After that TA is reset:

'TA=OFF'

And the audio program is continued. If the DURATION timer expired during TA, RT and PS will revert to the original RT, otherwise PS and RT values are replaced by DYNRT and DYNPS values as soon as new ARTIST and TITLE data in sent.

12.3. RadioText plus tagging

RadioText plus tagging can be used to allow RT+ enabled end user devices to extract certain information for further use. The C0x$_{DSP}$ tags RT artist and title data based on the data that is put in using the automation interface. This for example allows an end user device to correctly display artist and title and further use that data for example to link to an online music store, in case the user wants to buy the music.

To use RT+ tagging, an ODA application with AID 4BD7 needs to be added. In this AID a RDS group needs to be configured in which the ODA data (RT+) will be transmitted and both this group and group 3A (ODA) need to be inserted into the group sequence.

12.4. Built-in RDS Decoder

The C0x features a built-in RDS decoder (optional; only possible with firmware V3.14 or higher and TCP/IP module firmware V4.10 or higher), which allows RDS Lab, the premium RDS software decoder from the 2wcom team, to connect to a special TCP/IP decoder port of the C0x (configurable via ARCOS Config).
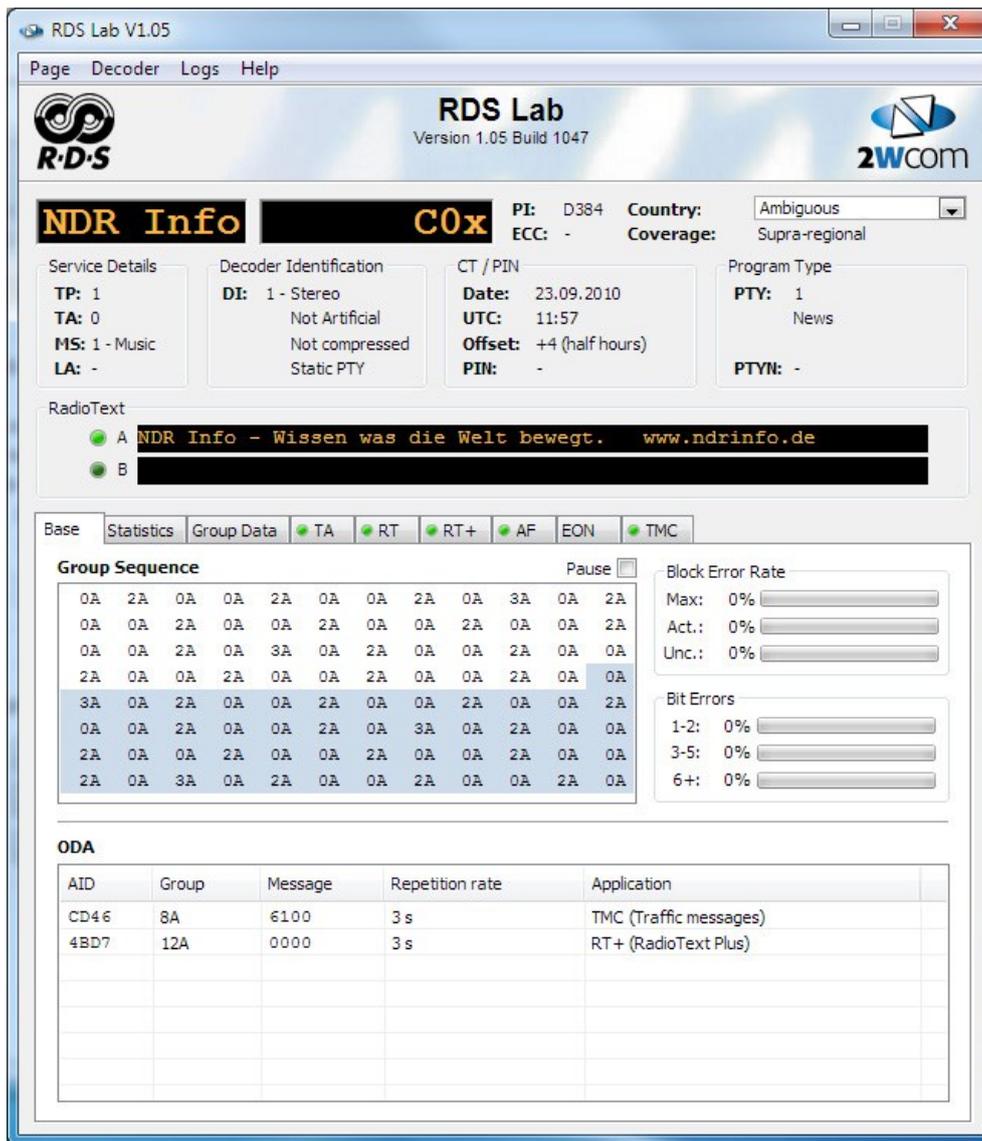
You can start RDS Lab from within ARCOS Config by just clicking the "Start Decoder…" button on the encoder "General" page, via the menu (Coder / Start Decoder…) or with the shortcut Ctrl D. It allows you to investigate, what kind of RDS output the C0x is currently generating without the need for an additional hardware FM/RDS decoder, especially useful during the set up phase of the encoder. RDS Lab will even show you RT+ information and TMC messages in plain text. For further information regarding RDS Lab please consult the separate documentation.

12.5. Automatic Daylight Saving Time

The C0x can automatically take care of changing the offset value to UTC when changing from daylight saving time to winter time or vice versa (only with firmware V3.22 or higher). You just have to set the corresponding rules for daylight saving time start and end with ARCOS Config (Hardware Setup / Real Time Clock).

12.6. Input Redundancy

Starting with firmware V3.50 it is possible to configure input redundancies. This is especially useful and necessary, if the C0x shall receive two redundant data inputs delivering the same data, where the C0x shall automatically switch over from main to the redundant backup input source, when data is missing at the main port for a defined time period. Otherwise the C0x will ignore the data from the backup input.

The four serial ports (DTE1-3, DTE Front) and the four standard IP ports (not the special automation system port) can act as a redundancy or backup port for a different main or master port. The possible combinations are completely free – a DTE port can be the backup port for another DTE port, an IP port can be the backup for a DTE port or vice versa and an IP port can be the backup for another IP port.

The timeout can be configured between 1 and 254 minutes and is the same timeout, which is used for the alarm signaling in case of missing input data.

When the timeout is disabled, no automatic switch over will take place, resulting in a permanent selection of the main input.

Example:
DTE1 is configured as a redundancy port for IP port 1; the timeout is set to 10 minutes.
As long as there is data for at least every 9:59 minutes at IP port 1, all input data from DTE1 will get ignored by the C0x.
When there is no input data at IP port 1 for 10:00 or more minutes, the C0x will start to accept data from DTE1. As soon as there is input data at IP port 1, the data from DTE1 will again get ignored at least for the next 10 minutes.

Please note, that this redundancy can only be one level deep, so you cannot configure a port to be a redundancy port for a port, which is itself already a redundancy port for another port.

The input redundancy configuration can be done using ARCOS Config V2.24 or higher.

13. Programmable device functions

The RDS encoders C02$_{DSP}$ and C04$_{DSP}$ have several functions, which can be programmed by the user. The following functions are available.

13.1. Relay functions

> ## NOTICE
>
> The relay contacts have a nominal rating of 0.5 A at 125 V AC / 60 V DC. The absolute maximum current rating is 1 A !

The relay contacts are accessible at the [Relay Output] connector on the rear panel of the unit. The relay 1...8 are floating SPST (single pole single throw) relay contacts (A & B) which are normally open. The relay 9...11 have SPDT (single pole double throw) relay contacts which switch the contact A between contact B and contact C (contact A and C are connected if relay is not actuated). It is possible to assign functions to the individual relay.

> **Note:** The function of relay 11 is fixed on mains supply loss / RDS loss and cannot be changed.

The relay functions can be programmed with the software Arcos Config, which is part of the supplied CD-ROM. The following relay functions are possible.

Function	Parameter	Relay is actuated if...
No function	-	No function means no activation at all.
TA	1=TA, 0=/TA	TA is active / inactive.
TP	1=TP, 0=/TP	TP is active / inactive.
MS	1=MS, 0=/MS	MS switch is set to Music / Speech.
PTY	0..31	Corresponding PTY is activated.
CT	1=CT, 0=/CT	CT is active / inactive.
RDS	1=RDS, 0=/RDS	RDS active / inactive.
VRF	1=VRF, 0=/VRF	VRF (ARI) is active / inactive.
Ref. Input Select	1..6	Corresponding reference setting table is active.
Data Set	1..8	Corresponding dataset is active.
Timeout	0..5 (0=all ports)	UECP timeout on interface occurred.
Pilot	1=Pilot, 0=/Pilot	Pilot signal is active / is missing.
EON-TA	1=EON-TA, 0=/EON-TA	EON TA is active / inactive.
Cold start	1=Coldstart, 0=/Coldstart	A cold start has been executed.
DSP Error	1=Error, 0=/Error	DSP is inactive >90ms.
IP Timeout	0..5 (0=all ports)	IP timeout on interface occurred.
Zidem*	30-61 (=Channel 0-31)	1: Main TCP/UDP port, 2: Port 2, ...

The programming requires a function and a parameter, which is specific to the function. This parameter sets the actual action.

Example:

On the function "Data Set" the parameter selects which dataset has to be active for a relay actuation.

* Option "Zidem" required

13.2. Opto-isolated input functions

NOTICE
Apply only ground (0 Volt) to switch the inputs. Never apply a positive or negative voltage!

The RDS encoder C02$_{DSP}$ and C04$_{DSP}$ have 12 non-floating opto-isolated inputs on the rear panel. These inputs are provided on a 25 pole female D-Sub connector. The opto-isolated inputs are internally supplied on the internal pin and can be activated by simply pulling the corresponding pin at the connector to ground. All opto-isolated inputs are programmable by the user.

The opto-isolated input functions can be programmed with ARCOS Config, which is part of the supplied CD-ROM. The following functions are possible:

Function	Parameter	An actuation causes the action:
no function	-	no function
TA	1=TA, 0=/TA	TA function is activated / deactivated
TP	1=TP, 0=/TP	TP function is activated / deactivated
MS	1=MS, 0=/MS	MS switch is set to Music / Speech
PTY	0..31	Corresponding PTY is activated
CT	1=CT, 0=/CT	CT function is activated / deactivated
RDS	1=RDS, 0=/RDS	RDS function is activated / deactivated
VRF	1=VRF, 0=/VRF	VRF (ARI) function is activated / deactivated
Ref. Input Select	1..6	Corresponding reference table is activated
Data Set	1..8	Corresponding dataset is activated
EON TA	1=EON TA, 0=/EON TA	EON TA function is activated / deactivated
Pilot Select	1=MPX Input1	Corresponding MPX input is selected

	2=MPX Input2	
SNMP Reset	1=Reset	Warnings are erased
Warm start	1	Warm start is initiated
Cold start	1	Cold start
TA Toggle	0	If opto-isolated input is actuated: TA is activated
		If opto-isolated input is not actuated: TA is deactivated
SNMP Trap	0=normal behavior 1=inverted behavior	In "normal" mode a triggered state will be reported, if the input is pulled to ground, otherwise the state is reported as idle.
Redundancy	0=normal 1=enforce standard 2=enforce redundancy	If the opto-isolated input is actuated with 1 as parameter, all configured redundancy ports will never accept data; the input is enforced to the master ports, the timeout doesn't matter. If the opto-isolated input is actuated with 2 as parameter, all master ports for which a redundancy port is defined, will never accept data; the input is enforced to the redundancy ports; the timeout doesn't matter. If the opto-isolated input is actuated with 0 as parameter, the redundancy behavior reverts back to normal using the configured timout.

Example:

If the parameter 1 is set to the function "TA" an actuation of the corresponding opto-isolated input sets the TA bit in the active dataset to 1 (active). If the parameter 0 is set instead, an actuation of the corresponding opto-isolated input sets the TA bit in the active dataset to 0 (inactive).

14. Maintenance and servicing

Maintenance

No special maintenance is necessary on the device. Dust can be removed with a dry duster. For cleaning use only neutral, non-corrosive detergents applied to a cloth - not the device.

Servicing

The modules of the device are complex and should be serviced only by authorized personnel.

The 2wcom Systems GmbH is equipped with special measurement and repair kits. Therefore a repair by the user is not intended.
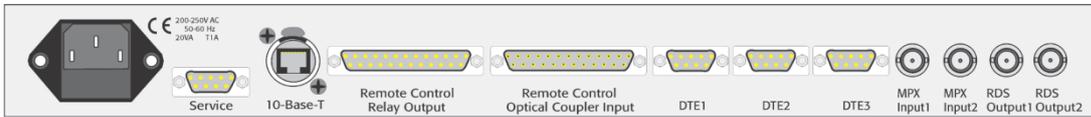
Calibration

Due to the design and construction of the device, no calibration is necessary.

15. Troubleshooting

The following chart is designed to help you to correct minor problems with the use of the device prior to contact our service department (report failures by email to *contact@2wcom.com* or fax to +49 461-662830-11). Also be sure to read the entire manual carefully, as this often helps in understanding and fixing typical problems.

Problem	Possible cause	Solution	Ref.
Power does not come on	• Power cable is improperly connected • Mains supply failure • Blown fuses	• Check supply cord • Check mains supply • Replace the fuses by the same type (accessible at mains connect. of the unit)	
Device does not work	• System halted	• Disconnect and reconnect the device from/to mains supply	
No RDS signal at the output(s)	• RDS function deactivated	• Activate RDS function	Page 24
RDS signal distorted	• Improper signal cable • Signal cable defect	• Use proper, screened cable only • Use faultless signal cable	
Level values are displayed in kHz instead of mVpp (or vice versa)	• Level unit is set to alternative unit	• Change unit for level display as desired. (mVpp or kHz)	Page 28
Device does not communicate via RS232C to connected units	• Data cable not properly connected • Wrong cable type • Wrong COM port of the PC selected	• Check connections • Use correct cable type (crossover / null modem cable) • Select the correct COM port in the PC software	Page 25
TCP/IP communication does not work	• TCP/IP settings (IP-address, Port, Netmask, Gateway) wrong • Network does not work at all. • Computer Network settings not correct • Firewall / Protection software configuration on computer not correct	• Check TCP/IP settings • Check network • Check settings • Check configuration	Page 26
SNMP Get requests are not working	• SNMP community strings of the device and the SNMP management tool are not aligned.	• Check / Align the SNMP community strings	Page 44
Relay output is not actuated as desired	• Relay output is not actuated as desired	• Check / Change programming of the relay functions	Page 60
Opto-isolated input does not activate the desired function	• Missing / Wrong programming of the opto-isolated input function	• Check / Change programming of the opto-isolated input functions	Page 61

RDS/RBDS C02 and C04 Encoder – Technical Details

RDS signal — according to CENELEC EN 50067 and ARD standard specification 5/3.8 (Leitungsprotokoll) **(optional)** and UECP V 6.01 protocol

Coding	differential and biphase
Modulation	double-sideband amplitude modulation (DSSC) with suppressed carrier
Centre frequency	57 kHz ±6 Hz
Bandwidth	±2.4 kHz
RDS Level	0 .. 8191 mVpp
RDS Pilot	adjustable in steps of <2°, range 0 .. 360°
Linear distortion	<0.5 dB between upper and lower sidebands
Signal to noise rate	>80 dB
Carrier supression	>85 dB

Signal generation RDS amplifier

Max. output level	16 Vpp
Level variation	<0.5 dB

Synchronisation

External	to auxiliary pilot of stereo generator or to pilot of MPX signal, frequency 19 kHz ±2 Hz
Internal	automatic switchover to internal crystal oscillator if external pilot fails, frequency 19 kHz ± 2 Hz

Inputs
Sync/MPX summation — for 19 kHz pilot/FM stereo MPX signal

Connector	BNC unbalanced
Max. input level	9 Vpp
Pilot level	TTL (square wave) or 0.4 Vpp to 1 Vpp (sine wave)
Input impedance	>10 kΩ

Outputs
57 kHz (+MPX) main output

Connector	BNC or Lemosa
Type	unbalanced/balanced
Max. load	300 Ω || 5000 pF
MPX summation	link-selected, AC-coupled
Gain	0 dB
Level variation	<0.5 dB
Frequency response flatness	<0.5 dB (40 Hz .. 53 kHz)
Output impedance	<40 Ω

57 kHz (+MPX) test output — rating same as main output

Connector	BNC unbalanced

Interfaces
Remote control input

Connector	12 opto isolated inputs
	25 pole sub-D female
	14 programmable functions available

Remote control output
(Messages)

11 relays (8x SPST, 3x SPDT)
(for DC: max. 30 V, 1 A, 10 W)
25 pole sub-D male
15 programmable functions available

Data interfaces — Input/output of RDS data and setup function

Connector	4 serial interfaces, RS-232C (1 front, 3 rear) 9 pole sub-D male
Transmission rate	1200 to 38400 baud, asynchronous
Data format	UECP, Universal Encoder Communication Protocol (EBU SPB 490)

TCP/IP data interface
(for model C04 optional available) — Input/output of UECP data and setup functions

Connector	Neutrik Ethercon/RJ45 (rear)
Type	full duplex 10/100 BASE-T
Data format	TCP, UDP, SNMP, IGMP (multicast)

Front panel

BNC test output
serial interface, RS-232C

LEDs	Power, TP,TP/EON, TA-TA/EON, Warning, Status, RDS, Pilot

(for model C04 not available):

LCDisplay	2x 40 characters
Jog wheel	impulse, ENTER button

RDS Features

PS, PI, TP, TA, PTY, PTYN, MS, DI, RT, CT, AF 64 lists, EON, EWS, ODA, TMC, TDC, IH, RP, PIN, SLC, LINKAGE, EPP, ECC, FFG, SPS, ODA,
8 data sets
16 program service numbers
optional:
Transparent RDS mode:
recorded data stream can be played again
(advantage for test- and measurement purposes)

General Data

Power consumption	40 VA
Case dimensions	19", 1 HU, 310/424/484 mm
Weight	<4 kg
Housing	steel plate (aluminum-zinc coated)
Operating temp. range	0° .. 45°C
Storage temp. range	-40 .. +70°C
Power supply	internal, 90 .. 260 V, 47 .. 63 Hz

Version 29.07.2016
These data are subject to modificatons and amendments.
Errors excepted.