NovaTec Kommunikationstechnik GmbH

Handbook

NovaTec Design Document

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CONTENTS

1 Introduction

The present document describes characteristics, structure, design, configuration, use, connection and bringing into service of NovaTec systems in all currently existing versions. Whilst doing so details of the hardware setup of the individual members of the system line are explained and the various operation areas are illustrated with application examples.

It is important, that system boundaries are described. Especially, if there are variances in certain constellations.

The various tools and resources available to the operator of the system are described and explained in an extra chapter. System boundaries, interaction and dependencies are depicted.

1.1 Safety instructions

- Never setup NovaTec systems close to heaters like radiators or close to strong electric or electromagnetic fields.
- NovaTec Systems must not be used in environments with a lot of dust or humidity and must never be exposed to direct solar irradiation.
- Please take care, that small metal parts like nails or wire pieces cannot get into the NovaTec systems via the cooling vent.
- A proper installation has to precede the use and initial operation of a NovaTec system.
- Never clean the chassis or housing with cleaning solvent or diluter and other aggressive agents. Only use a dry and soft cloth.
- If inside parts of the NovaTec system are visible due to the destruction of the outer shell immediately detach the system from the electric power system.
- Depending on the type of system external or internal power supplies are provided for the systems current supply. Cable sets for the corresponding type of feed-in are enclosed. Always use the original cable sets.
- Apart of the S3 series and the S5+ all NovaTec systems can also be delivered with redundancy capable power supplies. These power supplies have their power connector at the front.
- In order to avoid damages to people or things NovaTec systems must never be stored or used under influence of water, other liquids or rain etc.
- For safety reasons modifications or changes to NovaTec systems must never be undertaken by third party, unless a written permission by NovaTec is existent.
- NovaTec Kommunikationstechnik GmbH bears no responsibility for damages occurring by a system which was modified or changed by third parties.
- Assembly, installation and putting into service of NovaTec systems must only be executed by personnel, which has been trained and qualified by NovaTec.
- Please follow these safety instructions whenever installing or setting up a NovaTec system or parts of such.
- All NovaTec systems (apart of the S3 series) always have to be earthed with a 2.5mm² cable.
- If any problems arise during installation or during operation, which cannot be cleared with help of the explanations in this manual, NovaTec should be consulted.
- Apart of S3 and S5+ wall housing all NovaTec systems have to be installed in a sheltered 19" cabinet.
- All power supplies must not be connected to the electricity network until the system is fully installed.
- When forwarding systems to third parties this manual always has to be forwarded with the system.

VENTILATION

The NovaTec systems must never be installed in cabinets without active ventilation. Elevated temperature can destroy the NovaTec systems.

DUST (DIN 40046 PART 47)

The NovaTec systems must not be set up in dusty environments.

HUMIDITY (IEC 721 3K6)

The NovaTec systems must not be exposed to high humidity.

TEMPERATURE

NovaTec Systems may only be used in environments with temperatures from 0° C up to +40° C.

⚠️ In order to protect the NovaTec systems against interferences by atmospheric or static discharges like lightning all lines leaving the building have to be equipped with coarse surge protection.

1.2 Declarations of conformity

1.2.1 Declaration of conformity for S3 systems

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KONFORMITÄTSERKLÄRUNG
Declaration of Conformity

Gemäß dem Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG)
und der Richtlinie 1999/5/EG (R&TTE)
Appropriate to the Law of Radio and Telecommunication Terminal Equipment and the Directive 1999/5/EC (R&TTE)

Der Hersteller
The manufacturer

NovaTec Kommunikationstechnik GmbH
Technologiepark 9, D-33100 Paderborn

erklärt, dass das Produkt
declares that the product

NovaTec S3
(Typ: Telekommunikationsendeinrichtung)
(Type: Telecommunications terminal equipment)

bei bestimmungsgemäßer Verwendung den grundlegenden Anforderungen des §3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.
complies with the appropriate essential requirements of FTEG (Article 3 of the R&TTE) when used in its intended purpose.

Verwendungszweck: Verbindungs-Router für 2 ISDN S_0/U_{P0} Kanäle EDSS1, 2 analoge Telefon-Schnittstellen und bis zu 4 VoIP-Kanäle.
Intended purpose: Interconnection router for 2 ISDN BRI/U_{P0} channels EDSS1, 2 POTS interfaces (ATA) and up to 4 VoIP channels.

Richtlinie: 1999/5/EG (R&TTE), EMC 2004/108/EG, LVD 2006/95/EC, RoHS 2011/65/EU
Directive: 1999/5/EG (R&TTE), EMC 2004/108/EG, LVD 2006/95/EG, RoHS 2011/65/EU

- Gesundheit und Sicherheit gemäß:
  Health and Safety requirements contained in:

  FTEG § 3 (1) 1
  Richtlinie 1999/5/EG
  (R&TTE) (Artikel 3 (1) a)
  LVD 2006/95/EC

  Angewendete harmonisierte Normen:
  Applied harmonised standards:

  EN 60950-1:2006 + A11:2009

- Schutzanforderungen in Bezug auf elektromagnetische Verträglichkeit:
  Protection requirements with respect to electromagnetic compatibility:

  FTEG § 3 (1) 2
  Richtlinie 1999/5/EG (R&TTE)
  (Artikel 3 (1) b) EMC
  2004/108/EG

- Angewendete harmonisierte Normen:
  Applied harmonised standards:

  EN 55022:2010
  EN61000-3-2:2006 + A1:2009 + A2:2009
  Class A
  EN61000-3-3:2008
  EN 55024:2010

- Schnittstellenstandards:
  Interface standards:

  S_0: CTR3, 98/515/EG,24.04.98
  (TBR3, Nov.95, TBR3 A1, Dez.97)
  a/b: 1 TR 110

CE-Kennzeichnung auf dem Produkt angebracht:
CE mark affixed to the product:

Ja
Yes

Paderborn, 07.08.2013

Dipl.-Ing. M. Keyhani, Geschäftsführer/Managing Director

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KONFORMITÄTSERKLÄRUNG
Declaration of Conformity

Gemäß dem Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG)
und der Richtlinie 1999/5/EG (R&TTE)
Appropriate to the Law of Radio and Telecommunication Terminal Equipment and the Directive 1999/5/EC (R&TTE)

Der Hersteller The manufacturer	NovaTec Kommunikationstechnik GmbH Technologiepark 9, D-33100 Paderborn
erklärt, dass das Produkt declares that the product	**NovaTec S5+** (Typ: Telekommunikationsendeinrichtung) (Type: Telecommunications terminal equipment)

bei bestimmungsgemäßer Verwendung den grundlegenden Anforderungen des §3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.
complies with the appropriate essential requirements of FTEG (Article 3 of the R&TTE) when used in its intended purpose.

Verwendungszweck: Modularer-Verbindungs-Router für ISDN S_0/U_{P0}/$U_{(K)0}$/S_{2M} Kanäle EDSS1, analoge Telefon-Schnittstellen und VoIP-Kanäle.
Intended purpose: Interconnection router for ISDN BRI/U_{P0}/$U_{(K)0}$/S_{2M} channels EDSS1, POTS interfaces (ATA) and VoIP channels.

Richtlinie: 1999/5/EG (R&TTE), EMC 2004/108/EG, LVD 2006/95/EG, RoHS 2011/65/EU
Directive: 1999/5/EG (R&TTE), EMC 2004/108/EG, LVD 2006/95/EG, RoHS 2011/65/EU

• Gesundheit und Sicherheit gemäß: Health and Safety requirements contained in:	FTEG § 3 (1) 1 Richtlinie 1999/5/EG (R&TTE) (Artikel 3 (1) a) LVD 2006/95/EG
Angewendete harmonisierte Normen: Applied harmonised standards:	EN 60950-1:2006 + A11:2009 + A1:2010

• Schutzanforderungen in Bezug auf
  elektromagnetische Verträglichkeit:
  Protection requirements with respect to
  electromagnetic compatibility:
	FTEG § 3 (1) 2
	Richtlinie 1999/5/EG
	(R&TTE) (Artikel 3 (1) b)
	EMC 2004/108/EG

• Angewendete harmonisierte Normen: Applied harmonised standards:	EN 55022:2010 EN61000-3-2:2006 + A1:2009 + A2:2009 EN 55024:2010 EN 61000-4-2:2009 EN 61000-4-5:2006
• Schnittstellenstandards: Interface standards:	S_0: CTR3, 98/515/EG,24.04.98 (TBR3, Nov.95, TBR3 A1, Dez.97) a/b: 1 TR 110
CE-Kennzeichnung auf dem Produkt angebracht: CE mark affixed to the product:	Ja Yes

Paderborn, 03.02.2014

Dipl.-Ing. M. Keyhani, Geschäftsführer/Managing Director

1.2.3 Declaration of conformity for S6, S7 and S8 systems

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KONFORMITÄTSERKLÄRUNG
Declaration of Conformity

Gemäß dem Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG)
und der Richtlinie 1999/5/EG (R&TTE)
Appropriate to the Law of Radio and Telecommunication Terminal Equipment and the Directive 1999/5/EC (R&TTE)

Der Hersteller
The manufacturer

NovaTec Kommunikationstechnik GmbH
Technologiepark 9, D-33100 Paderborn

erklärt, dass das Produkt
declares that the product

NovaTec S6 and S7
(Typ: Telekommunikationsendeinrichtung)
(Type: Telecommunications terminal equipment)

bei bestimmungsgemäßer Verwendung den grundlegenden Anforderungen des §3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.
complies with the appropriate essential requirements of FTEG (Article 3 of the R&TTE) when used in its intended purpose.

Verwendungszweck: Modularer-Verbindungs-Router für ISDN S_0/U_{P0}/$U_{(K)0}$/S_{2M} Kanäle EDSS1, analoge Telefon-Schnittstellen und VoIP-Kanäle.
Intended purpose: Interconnection router for ISDN BRI/U_{P0}/$U_{(K)0}$/S_{2M} channels EDSS1, POTS interfaces (ATA) and VoIP channels.

Richtlinie: 1999/5/EG (R&TTE), EMC 2004/108/EG, LVD 2006/95/EG, RoHS 2011/65/EU
Directive: 1999/5/EG (R&TTE), EMC 2004/108/EG, LVD 2006/95/EG, RoHS 2011/65/EU

- Gesundheit und Sicherheit gemäß:
  Health and Safety requirements contained in:

  FTEG § 3 (1) 1
  Richtlinie 1999/5/EG
  (R&TTE) (Artikel 3 (1) a)
  LVD 2006/95/EG

  Angewendete harmonisierte Normen:
  Applied harmonised standards:

  EN 60950-1:2006 + A11:2009 + A1:2010

- Schutzanforderungen in Bezug auf
  elektromagnetische Verträglichkeit:
  Protection requirements with respect to
  electromagnetic compatibility:

  FTEG § 3 (1) 2
  Richtlinie 1999/5/EG
  (R&TTE) (Artikel 3 (1) b)
  EMC 2004/108/EG
  EN 55022:2010

- Angewendete harmonisierte Normen:
  Applied harmonised standards:

  EN61000-3-2:2006 + A1:2009 + A2:2009
  EN 55024:2010
  EN 61000-4-2:2009
  EN 61000-4-5:2006

- Schnittstellenstandards:
  Interface standards:

  S_0: CTR3, 98/515/EG,24.04.98
  (TBR3, Nov.95, TBR3 A1, Dez.97)
  a/b: 1 TR 110

CE-Kennzeichnung auf dem Produkt angebracht:
CE mark affixed to the product:

Ja
Yes

Paderborn, 27.08.2014

Dipl.-Ing. M. Keyhani, Geschäftsführer/Managing Director

1.2.4 Declaration of conformity for S20 and S21 systems

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KONFORMITÄTSERKLÄRUNG
Declaration of Conformity

Gemäß dem Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG)
und der Richtlinie 1999/5/EG (R&TTE)
Appropriate to the Law of Radio and Telecommunication Terminal Equipment and the Directive 1999/5/EC (R&TTE)

Der Hersteller The manufacturer	NovaTec Kommunikationstechnik GmbH Technologiepark 9, D-33100 Paderborn
erklärt, dass das Produkt declares that the product	**NovaTec S20, S20+ and S21** (Typ: Telekommunikationsendeinrichtung) (Type: Telecommunications terminal equipment)

bei bestimmungsgemäßer Verwendung den grundlegenden Anforderungen des §3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.
complies with the appropriate essential requirements of FTEG (Article 3 of the R&TTE) when used in its intended purpose.

Verwendungszweck: Modularer-Verbindungs-Router für ISDN S_0/U_{P0}/$U_{(K)0}$/S_{2M} Kanäle EDSS1, analoge Telefon-Schnittstellen und VoIP-Kanäle.
Intended purpose: Interconnection router for ISDN BRI/U_{P0}/$U_{(K)0}$/S_{2M} channels EDSS1, POTS interfaces (ATA) and VoIP channels.

Richtlinie: 1999/5/EG (R&TTE), EMC 2004/108/EG, LVD 2006/95/EG, RoHS 2011/65/EU
Directive: 1999/5/EG (R&TTE), EMC 2004/108/EG, LVD 2006/95/EG, RoHS 2011/65/EU

• Gesundheit und Sicherheit gemäß: Health and Safety requirements contained in:	FTEG § 3 (1) 1 Richtlinie 1999/5/EG (R&TTE) (Artikel 3 (1) a) LVD 2006/95/EG
Angewendete harmonisierte Normen: Applied harmonised standards:	EN 60950-1:2006 + A11:2009 + A1:2010
• Schutzanforderungen in Bezug auf elektromagnetische Verträglichkeit: Protection requirements with respect to electromagnetic compatibility:	FTEG § 3 (1) 2 Richtlinie 1999/5/EG (R&TTE) (Artikel 3 (1) b) EMC 2004/108/EG EN 55022:2010
• Angewendete harmonisierte Normen: Applied harmonised standards:	EN61000-3-2:2006 + A1:2009 + A2:2009 EN 55024:2010 EN 61000-4-2:2009 EN 61000-4-5:2006
• Schnittstellenstandards: Interface standards:	S_0: CTR3, 98/515/EG,24.04.98 (TBR3, Nov.95, TBR3 A1, Dez.97) a/b: 1 TR 110
CE-Kennzeichnung auf dem Produkt angebracht: CE mark affixed to the product:	Ja Yes

Paderborn, 27.08.2014

Dipl.-Ing. M. Keyhani, Geschäftsführer/Managing Director

2 Overview system family

The system line consists of the following chassis types:

2.1 S20 and S21 chassis for redundancy capable power supplies

Article number: 1F5011-1* and 1F5011-1R* (S20 and S20+)

19"/6 RU for mounting in 19" cabinets. The S20 can be fitted alternatively with CCU3, CCU4 or CCU6 and 15 further modules from the existing line cards. The seventeenth space cannot be equipped and is always sealed with a dummy blind. The newer S20 version can be equipped with one up to two redundancy capable power supplies (redundant power unit "RPU1" and "RPU2"). If only one power supply is used, the gap has to be closed with two additional dummy panels.

RPU1   RPU2

Picture 1: S20 (1F5011-1R) with redundancy capable power supplies (1F4042-2) and equipped with one CCU3

CCU is always inserted into the slot on the far left (slot 0) of the system.

: These S20 versions are discontinued from November 30th 2014. Replacement type (S21): 1F402X

*: X stands for the various models

Article number: 1F4020 (S21)

19"/6 RU for mounting in 19" cabinets. The S21 can be fitted alternatively with CCU3, CCU4 or CCU6 and 11 further modules from the existing line cards. In this version the S21 can be equipped with one and up to four redundancy capable power supplies (Redundant power unit „RPU1" to „RPU4"). If not all power supplies are used the gaps have to be closed with dummy units. The new backplane of the S21 includes an electric serial number additionally to the backplane ID as known from previous models, which can be retrieved by the element manager from NAMES version 3.0 on. When starting the system or when a power supply drops out the missing supply voltage is signalled acoustically and optically. This signal can also be transmitted to the element manager NAMES via the IP network by adjusting the configuration on the CCU appropriately. The alarm for each group of two power supplies can be turned off with the alarm reset button on the cover plate. The optical LED display shows the active state with a green light and the drop out of a power supply with a red light. Every power supply has its own connection cable and can be individually built in or out whilst the system is in operation. Two power supplies together supply the entire nominal load of 350 watt (70 ampere at +5 volt). In order to supply the same load in redundant mode three or better four power supplies have to be assembled. The S21 may be equipped with 230 volt or 48 volt power supply units. A mixed assembly of the two power supply versions is also possible.

Picture 2-a: S21 with redundancy capable power supply and equipped with one CCU4, 5x CAU-2, 5x ULU and 2x DC power supplies (1F4043-2) as well as 1x AC power supply (1F4043).

2.2 S20+ chassis for redundancy capable power supplies

Article number: 1F5011-2 and 1F5011-2R

*: This S20+ version is discontinued from November 30th 2014. Replacement: 1F402X

19"/6 RU for mounting in 19" cabinets. The S20+ can be equipped with up to three CCU3, CCU4 or CCU6 and 12 further modules from the existing line cards (S20+ is equal to three S6 in one chassis). In the newer version the S20+ can be equipped with one and up to two redundancy capable power supplies (redundant power unit „RPU1" and „RPU2"). If only one power supply is used the gap has to be closed with two additional dummy panels.

Barcode label ⇒

Two separate power cables

Picture 3: S20+ (1F5011-2R) with redundancy capable power supplies (1F4042-2), equipped with three CCU3

The difference between the discontinued S20+ without redundancy capability of the power supplies is visible at the power supply connector on the backplane and the serial number (barcode) on the front left side. The CCU is always (seen from the left) inserted into the first, sixth and eleventh slot of the system. The two last slots are closed with two dummy panels.

2.3 S6 chassis and S6+ chassis for redundancy capable power supplies

Article numbers: 1F5001S and 1F5009S

*: These S6 versions are discontinued from September 30th 2014. Replacement (S7): 1F401X

19"/3 RU for mounting in 19" cabinets. The S6 can be alternatively equipped with one CCU3, CCU4 or CCU6 and 4 further modules from the existing line cards. The newest version S6+ can be equipped with one and up to two redundancy capable power supplies (redundant power unit „RPU1" and „RPU2").

Barcode label ⇒

Picture 4: S6 without redundancy capable power supplies (1F5001S), equipped with one CCU3

The power socket is on the back. Identification through the barcode label on the front left.

RPU1

RPU2

Picture 5: S6+ can be equipped with one or two redundancy capable power supplies (1F5009S)

*: These S6 Versions are discontinued from September 30th 2014. Replacement (S7): 1F401X

The S6+ can be equipped with up to five modules like CCU3, CCU4 or CCU6 (always inserted on the lowermost slot), BCU (not with CCU4 or CCU6), CAU, ULU, MCU and DC4. The functions and descriptions of the modules can be found later on in this document.

Picture 6: S6+ Equipped with redundancy capable power supplies as well as CCU3, BCU, CAU, ULU and DC4

All sockets are accessible from the front.

DC power supply

RPU1

Dummy unit

Alarm reset button

Picture 6: S7 can be equipped with redundancy capable power supplies with 230 volt (AC) or 48 volt (DC) primary power supply. Here it is shown with dummy unit, alarm reset button, CCU4, 2x CAU and 2x ULU.

S7 is the replacement of the S6 series and with the new power supply concept has been adapted to the requirements of the new module generations. Every single redundancy capable power supply can provide the S7 with 160* watts. There are two power supply versions: One for AC and one for DC supply. Mixed mode with DC and AC is also possible. If one power supply drops out or if you activate single power supply mode an acoustic signal is sound, which can be reset by pushing the reset button.

If only using one power supply the gap should always be closed with a dummy unit.

The new backplane of the S8 hast got additionally to the Backplane-ID also the electronic Serial number, which can be requested by the element manager NAMES 3.0. At the start of the system or malfunctioning of one of the power supplies in a running system will be shown locally by an optical and acoustic signal. This signal can also be send to the NAMES 3.0 remotely via an IP network.

*: When using the DC power supply only 110 watts are available.

2.4 S5+ chassis

Article number: 1F5200 and 1F5201

19"/1,5 RU available for mounting in 19" cabinets or in wall or table housing. S5+ can be equipped with one CCU3, CCU4 or CCU6 and one further module from the existing line cards.

Picture 7: S5+ as 19" chassis (1F5201)

Picture 8: S5+ in table housing (1F5200)

2.5 S3 system

The S3 is non modular and laid-out in a wall or table housing. The S3 is available in different versions, each of which is available as independent system. For the S3 a 12 volt power supply is used, which is included in the scope of delivery.

2.6 System series in modular design, usable modules and their system limitations

All NovaTec systems assembled in a 19"chassis are built up modular and basically consist of:

1. Chassis: Includes the back plane and the slots.
2. Modules: These are all modules designed on double euro board size, which may be inserted into the slots of the 19"chassis. Some of these modules can additionally hold daughter boards. Some modules have a determined location due to the system architecture.
3. Daughter boards: These are the physical interfaces and are either equipped with two or with four interfaces.

The tables on the upcoming pages show the system limitations in accordance with:

1. Chassis and its maximum amount of slots.
2. Switching matrix and its maximum interconnect capacity.
3. Output of the Power supplies (the main power supplies in S20, S20+, S21, S6, S7 and S8 are dimensioned in such way, that the power output would be sufficient for all module combinations even when only using one redundancy capable power supply). There are only limitations of the power output for the BRI cards when using DC4 or when using the new daughter boards, which have units for phantom powering of BRI S_0 or U_{k0} interfaces on board.

Detailed information is available over our system configurator which can be provided by our sales team.

As the S3 is no modular system it is treated separately.

SYSTEM	S5+					S6 / S6+ / S7/ S8			
Feature list	**Splitter**		**Hybrid**			**Splitter**		**Hybrid**	
	CCU4[1]	CCU6	CCU4[1]	CCU6[1]		CCU4[1]	CCU6[1]	CCU4[1]	CCU6[1]
Max. amount of non-blocking PRI connections	3	3	3	3		3	3	4	4
Multiple non-blocking PRI connections									
Max. amount of non-blocking BRI connections	16	16	16	16		48	48	56	56
Max. amount of blocking BRI connections	16	16	16	16					
Max. amount of non-blocking U_0 connections (Uo board 2B1Q or 4B3T)	16	16	16	16		48	48	56	56
Max. amount of blocking U_0 connections (Uo board 2B1Q or 4B3T)	16	16	16	16					
Max. amount of non-blocking U_0 connections (ULU, 2B1Q)	4	4	4	4		16	16	16	16
Max. amount of blocking U_0 connections (ULU, 2B1Q)		4							
Max. amount of non-blocking U_{p0} connections	16	16	16	16		52	52	56	56
Max. amount of blocking U_{p0} connections		16							
Max. amount of non-blocking U_{k0} connections (4B3T or 2B1Q)	16	16	16	16		52	52	56	56
Max. amount of blocking U_{k0} connections (4B3T or 2B1Q)		16							
Max. amount of non-blocking analogue connection lines	16	16	16	16		52	52	112	112
Max. amount of blocking analogue connection lines		16							
Amount of media converters for VoIP								128	128
Max. amount of GSM channels per system									
Max. amount of SIM cards per system									

1 also applicable for CCU6

   * without dial tones

  ** with dial tones

*** without SIM server

SYSTEM	S20+					S20/ S21			
	Splitter		Hybrid			Splitter		Hybrid	
Feature list	CCU4	CCU6	CCU4[1]	CCU6[1]		CCU4[1]	CCU6[1]	CCU4[1]	CCU6[1]
Max. amount of non-blocking PRI connections	6	12	9	9		3	3	4	4
Multiple non-blocking PRI connections	possible	possible							
Max. amount of non-blocking BRI connections	84* 75**	84* 75**	156	156		60	60	64	64
Max. amount of blocking BRI connections	156	132							
Max. amount of non-blocking U_0 connections (ULU, 2B1Q)	84* 75**	84* 75**	156	156		60	60	64	64
Max. amount of blocking U_0 connections (Uko board, 2B1Q or 4B3T)	156	132							
Max. amount of non-blocking U_0 connections (Uko board, 2B1Q or 4B3T)	48	36	48	48		56	56	56	56
Max. amount of blocking U_0 connections (ULU, 2B1Q)	48	36							
Max. amount of non-blocking U_{p0} connections	84* 75**	84* 75**	156	156		60	60	64	64
Max. amount of blocking U_{p0} connections	156	132							
Max. amount of non-blocking analogue connection lines	156* 150**	156* 150**	156	156		120	120	128	128
Max. amount of blocking analogue connection lines	156	132							
Amount of media converters for VoIP		384						128	128
Max. amount of GSM channels per system									
Max. amount of SIM cards per system									

1 also applicable for CCU6

* without dial tones

** with dial tones

*** without SIM server

2.6.1 CCU4

Article number: 1F5050*

*: This article is discontinued from September 30th 2014. Replacement CCU6: V02MCCU6**

The CCU4 (Central Control Unit) is a hardware device, which can be used in the NovaTec systems S5+, S6, S6+, S7, S8, S20, S20+ and S21.

CAPACITY

The CCU4 incorporates different hard- and software functions of the CCU3 and BCU together in one hardware device and next to cutting costs makes it possible to implement the mentioned functions from the data sheet as follows:

- CPU card with Intel Atom 1.1 GHz processor
- 512 MByte SDRAM main memory
- 512 MByte flash memory
- Switching matrix operating capacity of 128 simultaneous connections (may be extended to 256 simultaneous connections)
- Integrated DSPs for RTP/sRTP
- 128 KByte Boot-PROM for system start and flash update
- Integrated DSP for multiple conferences and tone generation as well as synchronised announcement for MLPP
- 10/100/1000 Ethernet connection
- Two slots for clip on boards: ANA4, BRI, U0 and PRI cards
- IP4/IP6 dual stack possibilities
- RSA key according to RSA-2048 possible
- RJ45 sockets for on board interfaces
- USB interface
- LED display

POWERCONSUMPTION

Main board with CPU card: worst case 15 watts on 5 volt, 39 watts on 230 volt

HEAT EMMISION

Main board with CPU card: 140,4 kW/s on 230 volt

Line LED 16

Terminal area for sub module 2, consisting of 4 RJ45 sockets with status LEDs for every line.

Terminal area for sub module 1, consisting of 4 RJ45 sockets with status LEDs for every line.

Line LED 1

Ready LED for the entire module

Power LED

RESET button

USB interface

2x 10/100/1000 Ethernet connections for data and signalling. The upper connection can be configured for sole signaling like SIP and maintenance and the lower for sole RTP data streams. In default mode all signals and RTP data streams can only be taken from the upper connection. At the same time you still have two IP and MAC addresses.
Warning: If no separation between SIP and RTP is set, only the upper LAN socket is active

LED DISPLAY / FUNCTIONS		
LED-/ No.:	**State**	**Meaning**
Power LED	On	CCU4 has no voltage or is in default state
	Off	CCU4 has voltage and is not in default state
Ready LED	Off	CCU4 has no voltage or has not yet started to boot after reset or power on
	Flashing slowly	CCU4 has booted and is ready for use!
	Flashing fast	CCU4 is booting. If an error is found whilst booting, the boot procedure is stopped. The trouble code shown in this case still needs to be defined.
Line-LED 1, 3, 5, 7 and 9,11,13 ,15: green LED	Off	L1 is inactive.
	Flashing	---
	On	L1 is active.
Line-LED 2, 4, 6, 8 and 10, 12,14, 16: yellow LED	Off	Always off. (is not driven)
	Flashing	Always off. (is not driven)
	On	Always off. (is not driven)
LED of the Ethernet jack	Yellow on/ Flickering	100Mbit/ data service.
	Green on/ Flickering	1Gbit/ data service.
RESET button: Is activated with a pointed object!	Short tap	Cold boot
	Pressing it for three seconds after the BIOS has ended	CCU4 boots from default configuration.

RESET BUTTON

This button is secured against unmeant operation (only accessible with a pointed object) and shifts only the CPU (DRAM refresh is warranted) into reset status after being triggered in order to ensure the possibility to interpret the DRAM data at a later point of time. The activation of the reset button can be suppressed by the software in order to interpret the activation of the reset button as default configuration for a certain time period on demand when defined LED states show. [R + 1]

Operation of the reset button with the following LED states:

ff	29	Waits for 4 seconds for the default request through reset button. Previously: RAM test (Procedure of data line test and data cell test)

Normal phases	Power LED	Ready LED	Lines LED 1-16
Power on: CPU is in reset state	On	Off	Line LED 8-1: Off Line LED 16-9: Off
AMI/Kontron BIOS	On	On	Line LED 8-1: AMIBIOS8: POST codes Line LED 16-9: AMIBIOS8: DIM codes
NovaTec boot code: BIOS starts boot code (MBR) Boot code starts firmware	On	Flashing with 2 Hz	Line LED 8-1: NT boot error code Line LED 16-9: NT boot error code
Firmware runs in default mode	Off	Flashing with 0.5 Hz	State of the submodule interfaces: Green on: L1 active
Firmware runs in normal mode	On	Flashing with 0.5 Hz	State of the submodule interfaces: Green on: L1 active

Special phases	Power LED	Ready LED	Line LEDs 1-16
Debugger boot monitor active	On	On	Line LED 8-1: 4 steps at 100 msec 0x11 0x22 0x44 0x88 Line LED 16-9: Off
RSA key is created	On	Flashing with 0.5 Hz	Line LED 4-1: 6 steps at 1 sec 0x01 0x02 0x04 0x08 0x04 0x02 Line LED 8-5: 0x01 Line LED 16-9: Off
SCEP process running: 0x02 means: IP DNS resolution of the SCEP server 0x03 means: Signing of the certificates	On	Flashing with 0.5 Hz	Line LED 8-1: 6 steps at 1 sec 0x01 0x02 0x04 0x08 0x04 0x02 Line LED 9-5: 2/3 Line LED 16-9: Off

Checkpoint LED 8-1	POST-Codes Description
03	Disable NMI, Parity, video for EGA, and DMA controllers. Initialize BIOS, POST, Runtime, data area. Also initialize BIOS modules on POST entry and GPNV area. Initialized CMOS as mentioned in the Kernel Variable "wCMOSFlags."
04	Check CMOS diagnostic byte to determine if battery power is OK and CMOS checksum is OK. Verify CMOS checksum manually by reading storage area. If the CMOS checksum is bad, update CMOS with power-on default values and clear passwords. Initialize status register A. Initializes data variables that are based on CMOS setup questions. Initializes both of the 8259 compatible PICs in the system
05	Initializes the interrupt controlling hardware (generally PIC) and interrupt vector table.
06	Do R/W test to CH-2 count reg. Initialize CH-0 as system timer. Install the POSTINT1Ch handler. Enable IRQ-0 in PIC for system timer interrupt. Traps INT1Ch vector to "POSTINT1ChHandlerBlock."
07	Fixes CPU POST interface calling pointer.
08	Initializes the CPU. The BAT test is being done on KBC. Program the keyboard controller command byte is being done after Auto detection of KB/MS using AMI KB-5.
C0	Early CPU Init Start -- Disable Cache – Init Local APIC
C1	Set up boot strap processor Information
C2	Set up boot strap processor for POST
C5	Enumerate and set up application processors
C6	Re-enable cache for boot strap processor
C7	Early CPU Init Exit
0A	Initializes the 8042 compatible Key Board Controller.
0B	Detects the presence of PS/2 mouse.
0C	Detects the presence of Keyboard in KBC port.
0E	Testing and initialization of different Input Devices. Also, update the Kernel Variables. Traps the INT09h vector, so that the POST INT09h handler gets control for IRQ1. Un-compress all available language, BIOS logo, and Silent logo modules.
13	Early POST initialization of chipset registers.
20	Relocate System Management Interrupt vector for all CPU in the system.
24	Uncompress and initialize any platform specific BIOS modules. GPNV is initialized at this checkpoint.
2A	Initializes different devices through DIM. See DIM Code Checkpoints section of document for more information.
2C	Initializes different devices. Detects and initializes the video adapter installed in the system that has optional ROMs.
2E	Initializes all the output devices.
31	Allocate memory for ADM module and uncompress it. Give control to ADM module for initialization. Initialize language and font modules for ADM. Activate ADM module.
33	Initializes the silent boot module. Set the window for displaying text information.
37	Displaying sign-on message, CPU information, setup key message, and any OEM specific information.
38	Initializes different devices through DIM. See DIM Code Checkpoints section of document for more information. USB controllers are initialized at this point.
39	Initializes DMAC-1 & DMAC-2.
3A	Initialize RTC date/time.
3B	Test for total memory installed in the system. Also, Check for DEL or ESC keys to limit memory test. Display total memory in the system.
3C	Mid POST initialization of chipset registers.

Checkpoint LED 8-1	POST-Codes Description
40	Detect different devices (Parallel ports, serial ports, and coprocessor in CPU, … etc.) successfully installed in the system and update the BDA, EBDA…etc.
52	Updates CMOS memory size from memory found in memory test. Allocates memory for Extended BIOS Data Area from base memory. Programming the memory hole or any kind of implementation that needs an adjustment in system RAM size if needed.
60	Initializes NUM-LOCK status and programs the KBD typematic rate.
75	Initialize Int-13 and prepare for IPL detection.
78	Initializes IPL devices controlled by BIOS and option ROMs.
7C	Generate and write contents of ESCD in NVRam.
84	Log errors encountered during POST.
85	Display errors to the user and gets the user response for error.
87	Execute BIOS setup if needed / requested. Check boot password if installed.
8C	Late POST initialization of chipset registers.
8D	Build ACPI tables (if ACPI is supported)
8E	Program the peripheral parameters. Enable/Disable NMI as selected
90	Initialization of system management interrupts by invoking all handlers. Please note this checkpoint comes right after checkpoint 20h
A1	Clean-up work needed before booting to OS.
A2	Takes care of runtime image preparation for different BIOS modules. Fill the free area in F000h segment with 0FFh. Initializes the Microsoft IRQ Routing Table. Prepares the runtime language module. Disables the system configuration display if needed.
A4	Initialize runtime language module. Display boot option popup menu.
A7	Displays the system configuration screen if enabled. Initialize the CPU's before boot, which includes the programming of the MTRR's.
A9	Wait for user input at config display if needed.
AA	Uninstall POST INT1Ch vector and INT09h vector.
AB	Prepare BBS for Int 19 boot. Init MP tables.
AC	End of POST initialization of chipset registers. De-initializes the ADM module.
B1	Save system context for ACPI. Prepare CPU for OS boot including final MTRR values.
00	Passes control to OS Loader (typically INT19h).

DEVICE INITIALIZATION MANAGER (DIM) CODE CHECKPOINTS
(SEE POST-CODES I/O T 80H)

2A	Initialize different buses and perform the following functions: Reset, Detect, and Disable (function 0); Static Device Initialization (function 1); Boot Output Device Initialization (function 2). Function 0 disables all device nodes, PCI devices, and PnP ISA cards. It also assigns PCI bus numbers. Function 1 initializes all static devices that include manual con-figured on-board peripherals, memory and I/O decode windows in PCI-PCI bridges, and noncompliant PCI devices. Static resources are also reserved. Function 2 searches for and initializes any PnP, PCI, or AGP video devices.
38	Initialize different buses and perform the following functions: Boot Input Device Initializa-tion (function 3); IPL Device Initialization (function 4); General Device Initialization (func-tion 5). Function 3 searches for and configures PCI input devices and detects if system has standard keyboard controller. Function 4 searches for and configures all PnP and PCI boot devices. Function 5 configures all on-board peripherals that are set to an automatic configuration and configures all remaining PnP and PCI devices.

I/O AT 81H: BYTE: XY

Upper nibble X SHOWS displays the function and is shown with numbers from 0 to 8:

0 = func#0, disable all devices on the BUS concerned
1 = func#1, static devices initialization on the BUS concerned
2 = func#2, output device initialization on the BUS concerned
3 = func#3, input device initialization on the BUS concerned
4 = func#4, IPL device initialization on the BUS concerned
5 = func#5, general device initialization on the BUS concerned
6 = func#6, error reporting for the BUS concerned
7 = func#7, add-on ROM initialization for all BUSes
8 = func#8, BBS ROM initialization for all BUSes

Lower nibble Y displays the bus and is shown with numbers from 0 to 5:

0 = Generic DIM (Device Initialization Manager)
1 = On-board System devices
2 = ISA devices
3 = EISA devices
4 = ISA PnP devices
5 = PCI devices

NOVATEC CCU4 BOOT ERROR CODE (I/O AT 3A0H)
BOOT STEP CORRESPONDS TO LINE LED 8-1

Boot step LED 16-9 Hex	Boot step LED 8-1 Hex	Boot error code description
00	22	Initialising the interrupt handler of the boot application
00	23	Initialising the data in CMOS-RAM
ff	27	Locking the reset button (button no longer triggers a reset), only default request from now on
ff	28	RAM test: RAM size test. The RAM size found by the BIOS is checked.
ff	29	Waiting 4 seconds for the default request through the reset button. Previously: RAM test (Procedure of data line test and data cell test)
ff	20	Waiting for the release of the reset button (only if still held)
00	21	Unlocking the reset button (button triggers reset again)
00	2d	Copying the firmware from the SSD board into the store from address „K_BOOTPROM_FW_COPY_LOCATION" on and checking the firmware there (FW header section checksum etc.)
00	2e	Selection of the applications to be started: boot monitor, normal firmware or boot prom firmware.
00	2a	Loading of the selected applications into the working memory
00	2b	Executing loaded applications.

MARVELL SWITCH ETHERNET CONNECTION

The LED displays for connections 1 and 2 are identical.

LED	Colour	Meaning
LED1	Green	On 1000Mb/s Link, Off-Else
LED1	Orange	On 100Mb/s Link, Off-Else
LED2	Yellow	On: Link, Blink: Activity, Off: No Link

CONNETOR PIN ASSIGNMENT OF THE CCU4

ISDN RJ45

PIN	Signal
1	NC
2	NC
3	Rb1
4	Tb1
5	Ta1
6	Ra1
7	NC
8	NC

USB client

PIN	Signal
1	+5V
2	D-
3	D+
4	GND

RJ45 GB Ethernet connector 1

PIN	Signal
1	ETH1_MDIP0
2	ETH1_MDIN0
3	ETH1_MDIP1
4	ETH1_MDIN1
5	ETH1_MDIP2
6	ETH1_MDIN2
7	ETH1_MDIP3
8	ETH1_MDIN3

RJ45 GB Ethernet connector 2

PIN	Signal
1	ETH2_MDIP0
2	ETH2_MDIN0
3	ETH2_MDIP1
4	ETH2_MDIN1
5	ETH2_MDIP2
6	ETH2_MDIN2
7	ETH2_MDIP3
8	ETH2_MDIN3

2.6.2 CCU6

2.6.2.1 CCU6 with NovaTec Vortex CPU Card

Article number: **V02MCCU6NT**

The CCU6 integrates various hardware- and software components of CCU3 and BCU or CCU4 on one unified hardware platform. Due to these measures, it allows the reduction of costs and energy consumption. CCU6 includes the following functions:

There are two models of CCU6 available. One model includes the high performance CPU Card, which allows higher channel numbers and all the features of a Session border controller. The second model (light Version) is for less Performance applications. Visually there are no differences on the front panel between the two models. Only by the different serial numbers on the labels are they to identify

- In spite of a second LAN interface in CCU4, CCU6 provides an SFP interface on the front panel. This SFP interface can be used to insert fibre optic or LAN SFP-Modules.
- A doubled switching capacity (512 Channels) and doubled number of Codecs (512 Codecs) on board.

- CPU card "NovaTec VORTEX86EX" with 32 Bit 1 Core 400 MHz DMP-CPU for the Light version.
- 2 GByte DDR3 RAM Main-Memory.
- 2 GByte Flash Micro-SD Flash Memory.
- Switching Matrix of 512 simultaneously TDM connections.
- On board DSPs for RTP/sRTP.
- Integrated DSPs for generating of many Conferences and Tons and also synchronized announcements for MLPP.
- 1x 10/100/1000-T Ethernet-Socket on the front panel.
- 1x SFP (Small Form-factor Pluggable) Mini-GBIC Slot on the front panel.
- Two available plugin spaces for daughter boards like: ANA4, SUP4, U0 and S2M/E1 cards.
- Both IP4/IP6 Dual-Stack available.
- RSA Key-Store i.e. to RSA-2048.
- Integrated MARVELL „Link Street" 2 x Ethernet-Phy and 2x Serdes Switches.
- RJ45 Sockets for the daughter board interfaces on the front panel.
- USB interface for factory proposes.
- 16 Status LEDs for the daughter board interfaces and 2 System-Status LEDs.

POWER CONSUMPTIONS

Mainboard with CPU card but without daughter boards and SFP Module:

Worst case 7,5 Watt / 5 Volt, 12,75 Watt / 230 Volt

Front panel LED's:

The NovaTec Error und Boot-Codes remain the same as CCU4.

HEATH EMISSION

Mainboard with CPU card: 36 kW/s at 230 Volt

2.6.2.2 CCU6 with TQ-Group CPU-Card

Article number: **V02MCCU6XX**

- CPU Card „TQMxE39M-Ax" with Intel Atom Apollo Lake E3930 (2 Core 64 Bit CPU) 2x1,3 Ghz
- 2 GByte DDR3 RAM Main memory
- 16 GByte Flash eMMC-SD Flash Memory or 2 GByte SD-Card on the Main board
- Switching capacity of 512 TDM connections
- Integrated DSPs for RTP/sRTP
- Integrated DSPs for generating of many Conferences and Tons and also synchronized announcements for MLPP.
- 1x 10/100/1000-T Ethernet-Socket on the front panel.
- 1x SFP (Small Form-factor Pluggable) Mini-GBIC Slot on the front panel.
- Two available plugin spaces for daughter boards like: ANA4, SUP4, U0 and S2M/E1 cards.
- Both IP4/IP6 Dual-Stack available.
- RSA Key-Store i.e. to RSA-2048.
- Integrated MARVELL „Link Street" 2x Ethernet-Phy and 2x Serdes Switches.
- RJ45 Sockets for the daughter board interfaces on the front panel.
- USB interface for factory proposes.
- 16 Status LEDs for the daughter board interfaces and 2 System-Status LEDs.

POWER CONSUMPTIONS

Mainboard with CPU card but without daughter boards and SFP Module:

Worst case 15,5 Watt / 5 Volt, 26 Watt / 230 Volt

Front panel LED's:

The NovaTec Error und Boot-Codes remain the same as CCU4.

LED for line interface 16

4 Sockets for daughter board 2 including status LEDs for each Line

4 Sockets for daughter board 1 including status LEDs for each Line.

LED for line interface 1

Ready-LED for the whole unit

Power LED

RESET button

USB interface

1x 10/100/1000 Ethernet-Socket for Data and Signalling. In Default mode all Signalling and RTP Data will be available on this socket only. For each of the data streams are one extra IP and one extra MAC address to be used. **Attention**: Even, when RTP and SIP are not separated in the setup. This socket will provide all data streams.

1x SFP-Socket for Fibre or any other SFP Module

LED STATUS / MODE		
LED-/ No:	**Status**	**Meaning**
Power-LED	Off	CCU6 has no power or it is in Default-Mode.
	On	CCU6 has got power and is not in Default-Mode. Vocallo is ok.
	blinking	Vocallo is loading
Ready- LED	Off	CCU6 has no power or has not started yet, after a RESET or Power-on restart.
	Slow blinking	CCU6 has rebooted successfully and ready for operation!
	Fast blinking	CCU6 is in booting status. If an error occurs within this phase, the boot sequence will be stopped.
Line interface-LED 1, 3, 5, 7 and 9,11,13 ,15: green LED	Off	Layer 1 is inactive.
	Blinking	---
	On	Layer 1 is active.
Line interface-LED 2, 4, 6, 8 and 10, 12,14, 16: yellow LED	Off	Always off (not in use)
	Off	Always off (not in use)
	Off	Always off (not in use)
LED of the Ethernet socket	Yellow on/ Flicker	100Mbit mode.
	Green on/ Flicker	1Gbit mode.
RESET button: press it with a sharp item!	Short tap	Cold start
	Press for 3 seconds after the BIOS boot phase	CCU starts with the Default Configuration.

CCU

RESET-BUTTON

This button has been protected to avoid unwanted operation (can be reached only with a sharp pointed item) and by use it forces the CPU to reset and able to trace of the RAM data for analyse proposes. See more in the below explanation.

Use of the RESET-Button at the following LED states:

ff	29	Wates for 4 seconds for the Default request by pressing the Reset button a second time.

Standard Phase	Power-LED	Ready-LED	Line LED 1-16
Power-On: CPU is in Reset	on	off	Line-LED 8-1: off Line-LED 16-9: off
BIOS	on	on	Line-LED 8-1: BIOS: POST-Codes Line-LED 16-9: BIOS: DIM-Codes
NovaTec Boot-Code: BIOS starts Boot-Code (MBR) Boot-Code starts Firmware	On	Blinking with 2 Hz	Line-LED 8-1: NT Boot error Code Line-LED 16-9: -
Firmware is running in Default mode	Off	Blinking with 0.5 Hz	Any of the green line LEDs: on: Layer-1 of the line is active
Firmware in normal mode	on	Blinking with 0.5 Hz	Any of the green line LEDs: on: Layer-1 of the line is active

Step	LED 15	LED 14	LED 13	LED 12	LED 11	LED 10	LED 9	LED 8
1	-	-	-	-	-	-	-	-
2	-	X	-	-	-	-	-	-
3	-	-	X	-	-	-	-	-
4	-	-	-	X	-	-	-	-
5	-	-	-	-	X	-	-	-
6	-	-	-	-	-	X	-	-
7	-	X	-	-	-	X	-	-
8	-	-	X	-	-	X	-	-
9	-	-	-	-	X	X	-	-
10	-	-	-	-	X	X	-	-
11	-	-	-	-	X	X	-	-
12	X	-	-	-	X	X	-	-
13	-	X	-	-	X	X	-	-
14	-	-	X	-	X	X	-	-
15	-	-	-	X	X	X	-	-
16	-	-	-	X	X	X	-	-
17	X	-	-	X	X	X	-	-
18	-	X	-	-	X	X	X	-
19	-	-	X	X	X	X	X	-
20	-	-	-	X	X	X	X	-
21	-	-	-	X	X	X	X	-
22	-	-	-	X	X	X	X	-
23	-	-	-	X	X	X	-	X
24	-	-	-	X	X	X	-	-
25	-	-	-	X	X	X	-	-
26	-	-	-	X	X	X	-	-
27	-	-	-	X	X	-	X	-
28	-	-	-	X	X	-	-	X
29	-	-	-	X	X	-	-	-
30	-	-	-	X	-	X	-	-
31	-	-	-	-	X	X	-	-
32	-	-	-	-	X	-	X	-
33	-	-	-	-	X	-	-	-
34	-	-	-	-	X	-	-	-
35	-	-	-	-	X	-	-	-
36	-	-	-	-	-	-	X	-
37	-	-	-	-	-	-	-	X

Specific Phase	Power-LED	Ready-LED	Line-LEDs 1-16
Debugger Boot-Monitor active	on	on	Line-LED 8-1: 4 steps each 100 msec 0x11 0x22 0x44 0x88 Line-LED 16-9: off
RSA Key is being generated	on	Blinking with 0.5 Hz	Line-LED 4-1: 6 steps each 1 sec 0x01 0x02 0x04 0x08 0x04 0x02 Line-LED 8-5: 0x01 Line-LED 16-9: off
SCEP Process is running: 0x02 means: IP DNS look up of the SCEP Server 0x03 means: Signing the Certificate	on	Blinking with 0.5 Hz	Line-LED 8-1: 6 steps each 1 sec 0x01 0x02 0x04 0x08 0x04 0x02 Line-LED 9-5: 2/3 Line-LED 16-9: off

BIOS: POST-CODES (I/O AT 80H) CHECKPOINT CORRESPONDS TO LINE-LED 8-1

The BIOS Post-Codes shall be requested for each CPU Board.

NOVATEC CCU4 / CCU6 BOOT ERROR CODE (I/O AT 3A0H) BOOT-STEP CORRESPONDS TO LINE-LED 8-1

Boot-Step LED 16-9 Hex	Boot-Step LED 8-1 Hex	Boot Error Code description
00	22	Initialisation of the interrupt handler of the Boot Application
00	23	Initialisation of the Data in CMOS-RAM
ff	27	The Reset button is locked. (The button does not trigger any reset any-more.) From now on, the default mode is requested.
ff	28	RAM-Test: RAM-Size Test. The RAM Size is being checked by BIOS.
ff	29	Waiting 4 seconds for the default request by a trigger of the Reset button.
ff	20	Waiting for the release of the Reset button in case it is still pressed.
00	21	The Reset button is released now and can generate a Reset again.
00	2d	Copy the Firmware from the SSD disk into the RAM from Address „K_BOOTPROM_FW_COPY_LOCATION" and check the copied Firmware (FW-Header Section-Checksum etc.)
00	2e	Selection of application to be started: (Boot-Monitor, normal Firmware or Bootprom-Firmware.
00	2a	Load the selected Application into the Working memory
00	2b	Start to execute the loaded Application.

MARVELL SWITCH ETHERNET-LINK

The LEDs of the sockets 1 and 2 show different meanings

Socket1: SFP

LED	Colour	Meaning
LED	Green	On: Link, Blinking: Activity, Off: No Link

Socket2: LAN

LED	Colour	Meaning
LED1	Orange	On 1000Mb/s Link, Off-Else
LED1	Green	On 100Mb/s Link, Off-Else
LED2	Yellow	On: Link, Blinking: Activity, Off: No Link

SOCKET PINING OF CCU4 / CCU6

ISDN RJ45

PIN	Signal
1	NC
2	NC
3	Rb1
4	Tb1
5	Ta1
6	Ra1
7	NC
8	NC

USB-Client

PIN	Signal
1	+5V
2	D-
3	D+
4	GND

RJ45 GB Ethernet-Connector 1

PIN	Signal
1	ETH1_MDIP0
2	ETH1_MDIN0
3	ETH1_MDIP1
4	ETH1_MDIN1
5	ETH1_MDIP2
6	ETH1_MDIN2
7	ETH1_MDIP3
8	ETH1_MDIN3

SFB Connector

PIN	Signal
1	ETH2_MDIP0
2	ETH2_MDIN0
3	ETH2_MDIP1
4	ETH2_MDIN1
5	ETH2_MDIP2
6	ETH2_MDIN2
7	ETH2_MDIP3
8	ETH2_MDIN3

NECESSARY PATCH CABLES DEPENDING ON THE SUBMODULES

PRI configuration

PIN R45	Function	Normal marking on NT
3	Receive, NT to TE (+)	S2m ab/a
4	Transmit, TE to NT (+)	S2m an/a
5	Transmit, TE to NT (-)	S2m an/b
6	Receive, NT to TE (-)	S2m ab/b

BRI (S0) configuration

PIN R45	Function	Normal marking on NT
3	Receive, NT to TE (+)	b2
4	Transmit, TE to NT (+)	b1
5	Transmit, TE to NT (-)	a1
6	Receive, NT to TE (-)	a2

BRI (Upo/Uko) and analogue configuration

PIN R45	Function	Normal marking on NT
4		a
5		b

RJ45 cross cabling of the patch panel

So - NT

CCU/CAU

So - TE

CCU/CAU

S2m - NT

CCU/CAU

S2m - TE

CCU/CAU

Up0, Uk0, ANA

CCU/CAU

PIN ASSIGNMENT OF RJ45 CONNECTOR ON CCU4 AND CAU2

Application	1	2	3	4	5	6	7	8
U_{P0}, U_{K0}, U_0				1a	1b			
Analogue telephone				a	b			
ISDN BRI			2a	1a	1b	2b		
ISDN PRI (E1)			Rx	Tx	Tx	Rx		

SWITCHING MATRIX TABLE FOR CCU4

Function	Line/Subscriber/ Channels	Limitation	Non-blocking TDM-TDM	TDM-IP
CCU4.0	128 RTP and 128 PCM, 0 RTP 256 PCM	By license	256	128
5x CAU/CAU2 with 3x BRI/Uk0 module and 1x CAU/CAU2 with 1x BRI/Uk0 module	64 ISDN lines 128 subscribers	IOM	Yes	Yes
10x CAU/CAU2 with 3x BRI/Uk0 modules and 1x CAU/CAU2 with 2x BRI/Uk0 modules	128 ISDN lines 256 subscribers	IOM	Yes	No
15x CAU/CAU2 with 3x analogue modules	180 analogue lines 180 subscribers	Chassis	Yes	No
14 x ULU	56 ISDN lines 112 subscribers	ULU	Yes	Yes
1 x CAU/CAU2 with 1x PRI module	2 ISDN lines 60 subscribers	PBus	Yes	Yes
CCU4.0 with 2x PRI modules	4 ISDN lines 120 subscribers	CCU/PBus	Yes	Yes
CCU4.0 with 2x BRI/ Uk0 modules	8 ISDN lines 16 subscribers	CCU/modules	Yes	Yes
CCU4.0 with 2x BRI/ Uk0 modules	8 ISDN lines 16 subscribers	CCU/modules	Yes	Yes
CCU4.0 with 2x analogue modules	8 analogue lines 8 subscribers	CCU/modules	Yes	Yes

Maximum:

6 x PRI interfaces non-blocking TDM-TDM are 180 subscribers. With TDM-IP connections the limitation with the current licenses lies at 128 subscribers.

2.6.3 CCU3

Article number: 1F5022-4

EoP, stock may still be available.

The CCU3 (Central Control Unit) is a hardware device, which can be used in the NovaTec systems S5+, S6, S6+, S7, S20, S20+ and S21 and represents the switching matrix and central control of the NovaTec AMGWs S5+ to S21. The CCU3 was replaced by CCU4.

The CCU3 also has the **functions**

- MoH and sound generation
- ISDN, IP (TLS) and SIP signalling
- Two slots for daughter boards: ANA4, BRI, Uk0 and PRI boards
- All clock sources and PLLs across systems

CAPACITY

- Switching matrix for up to 64 simultaneous connections
- CPU performance
- Storage capacity
- IP interface: 100Base-T
- Two slots for NovaTec daughter boards (except for GSM2 board)

Picture 9: CCU3 (lateral position as when built into 3 RU chassis)

LED DISPLAY / FUNCTIONS		
LED-/ No.:	**State**	**Meaning**
Power LED	Off	CCU3 has no voltage!
	On	CCU3 has voltage and the PROM has started to run!
Ready LED	Off	CCU3 has no voltage or has not yet started to boot after a reset or power on!
	Flashing slowly	CCU3 has booted and is ready for use!
	Flashing fast	CCU3 is booting. If an error is found whilst booting the boot procedure is stopped. (Error code: see definition of LED states 1-8)
LED 1 to 8	Off	CCU3 has no daughter boards or these are not configured!
	On	The corresponding line of the daughter board is in operating state!
RESET button: Is activated with a pointed object!	Short Tap	Cold boot!
	Pressing it for three seconds after the BIOS has ended	CCU3 boots from default configuration.

Picture 10: CCU3 (upright position as when built into 6 RU chassis)

CCU3 CONNECTOR PIN ASSIGNMENT WITH BRI AND PRI BOARDS

Plug	Interface		Signal	Line colour	Row	Contact
1	BRA	1	Transmit A	white	A	2
	BRA		Transmit B	brown	C	2
	BRA		Receive A	green	A	4
	BRA		Receive B	yellow	C	4
	BRA	2	Transmit A	grey	A	6
	BRA		Transmit B	pink	C	6
	BRA		Receive A	blue	A	8
	BRA		Receive B	red	C	8
	BRA	3	Transmit A	black	A	10
	BRA		Transmit B	violet	C	10
	BRA		Receive A	grey/pink	A	12
	BRA		Receive B	red/blue	C	12
	BRA	4	Transmit A	white/green	A	14
	BRA		Transmit B	brown/green	C	14
	BRA		Receive A	white/yellow	A	16
	BRA		Receive B	yellow/brown	C	16
2	PRA	5	Transmit A	white	A	18
	PRA		Transmit B	brown	C	18
	PRA		Receive A	green	A	20
	PRA		Receive B	yellow	C	20
	PRA	6	Transmit A	white	A	22
	PRA		Transmit B	brown	C	22
	PRA		Receive A	green	A	24
	PRA		Receive B	yellow	C	24
	Free				A	26
	Free				C	26
	Free				A	28
	Free				C	28
	Free				A	30
	Free				C	30
	Free				A	32
	Free				C	32

CCU3 CONNECTOR PIN ASSIGNMENT WITH ANA BOARD (ANALOGUE)

Plug	Interface		Line	Signal	Line colour	Row	Contact
1	Ring	1	1	Wire A	white	A	2
	Tip			Wire B	brown	C	2
	free				green	A	4
	free				yellow	C	4
	Ring	2	2	Wire A	grey	A	6
	Tip			Wire B	pink	C	6
	free				blue	A	8
	free				red	C	8
	Ring	3	3	Wire A	black	A	10
	Tip			Wire B	violet	C	10
	free				grey/pink	A	12
	free				red/blue	C	12
	Ring	4	4	Wire A	white/green	A	14
	Tip			Wire B	brown/green	C	14
	free				white/yellow	A	16
	free				yellow/brown	C	16
2	free	5	1		white	A	18
	free				brown	C	18
	free				green	A	20
	free				yellow	C	20
	free	6	2		grey	A	22
	free				pink	C	22
	free				blue	A	24
	free				red	C	24
	free	7	3		black	A	26
	free				violet	C	26
	free				grey/pink	A	28
	free				red/blue	C	28
	free	8	4		white/green	A	30
	free				brown/green	C	30
	free				white/yellow	A	32
	free				yellow/brown	C	32

CCU3 RJ45 GB Ethernet connector 1

PIN	Signal
1	ETH1_MDIP0
2	ETH1_MDIN0
3	ETH1_MDIP1
4	ETH1_MDIN1
5	ETH1_MDIP2
6	ETH1_MDIN2
7	ETH1_MDIP3
8	ETH1_MDIN3

V24 interface

PIN	Signal
1	NC
2	Receive data Input
3	Transmit data Output
4	Data terminal ready Output
5	System ground ----------
6	Data set ready Input
7	Request to send Output
8	Clear to send Input
9	NC

SWITCHING MATRIX TABLE FOR CCU3

Function	Line/Subscriber/ Channels	Limitation	Non-blocking	
			TDM-TDM	TDM-IP
CCU3.3	60 PCM	TCM switching matrix	60	60
4x CAU with 3x BRI/ Uko modules	48 ISDN lines 96 subscribers	IOM	Yes	Yes
4x CAU with 3x BRI/ Uko modules	48 ISDN lines 96 subscribers	IO	Yes	No
5x CAU with 3x analogue modules	60 analogue lines 60 subscribers	TCM switching matrix	Yes	No
12x ULU	48 ISDN lines 96 subscribers	ULU	Yes	Yes
1x CAU with 1x PRI module	ISDN line 60 subscribers	PBus	Yes	Yes
CCU3.3 with 2x PRI modules	ISDN Line 60 inbound and 60 outbound traffic	CCU/PBus	Yes	Yes
CCU3.3 with 2x BRI/ Uko modules	8 ISDN lines 16 subscribers	CCU/modules	Yes	Yes
CCU3.3 with 2x BRI/ Uko modules	8 ISDN lines 16 subscribers	CCU/modules	Yes	Yes
CCU3.3 with 2x analogue modules	8 analogue lines 8 subscribers	CCU/modules	Yes	Yes

2.6.4 MCU

Item No: 1F5027-3

EoP, stock may still be available.

The MCU (Mobile Control Unit) is a hardware device, which can be used in the NovaTec systems S5+, S6, S6+, S7, S20, S20+ and S21 and represents the switching matrix and central control of the NovaTec GSM gateways S5+ to S21.

MCU also has the **functions**

- MoH and sound generation
- ISDN, IP (TLS) and SIP signalling
- Two slots for daughter boards:
  1x GSM2E board and 1x ANA4 or BRI or 1x PRI board.
- All clock sources and PLLs across systems

CAPACITY

- Switching matrix for up to 64 simultaneous connections
- CPU performance
- Storage capacity
- IP interface: 100Base-T
- Two slots for NovaTec clip on boards

| Terminal area of the daughter board | SIM card holder and LED array | Two antenna connectors | 10/100-BaseT |

Picture 11: MCU (lateral position as when built into 3 RU chassis)

LED status after card boot and diagnostic

	LED 4	LED 3	LED 2	LED 1
The Module is in the loading or configuration stage	⊗	○	○	○
Configuration loaded, but the SIM is missing	○	⊗	○	○
- Configuration o.k. - SIM o.k. - PIN failed	⊗	⊗	○	○
- Configuration o.k. - SIM o.k. - PIN wrong	○	○	⊗	○
- No provider available - To low receive level - To high bit error rate	⊗	○	⊗	○
- Card is empty or not released	○	⊗	⊗	○
- Hardware trouble: - The GSM engine causes error; - The UARTs cause error; - There is or are some minor malfunctions which does not allow the normal operation.	⊗	⊗	⊗	○

LED status during running mode

	LED 4	LED 3	LED 2	LED 1	
Field level 13% - 25% of max.	○	○	○	●	⊗
Field level 26% - 50% of max.	○	○	●	●	⊗
Field level 51% - 75% of max.	○	●	●	●	⊗
Field level 76% - 100% of max.	●	●	●	●	⊗

The signal level indication is steady on in running mode and shows the ratio of the receive signal level to the maximum possible receive signal level in percentage.
In a connection mode the signal level indications LED4, LED3 and LED2 keep steady on and the LED1 starts to flash.

●	LED is continuously shining
⊗	LED is flashing
○	LED is off

Picture 12: MCU (upright position as when built into 6 RU chassis)

2.6.5 CAU

Article number: 1F5020-4

EoP, stock may still be available.

The CAU (Carrier Unit) is a hardware device, which can be used in the NovaTec systems S5+, S6, S6+, S7, S20, S20+ and S21 and serves as carrier unit for NovaTec daughter boards.

The CAU has three slots for daughter boards.

Depending on the assembly, the CAU can provide for the following amount of interfaces:

- PRI boards: 6 interfaces (with CCU4 only two PRI interfaces)
- BRI boards: 12 interfaces
- ANA4 boards: 12 interfaces

Picture 13: CAU (lateral position as when built into in 3 RU chassis)

LED display / functions		
1	on	Daughter board existent
1	off	Daughter board not existent
2	on	Daughter board existent
2	off	Daughter board not existent
3	on	Daughter board existent
3	off	Daughter board not existent
all 4	on	CAU not configured

LED order:
Upper left: 1
Bottom left: 2
Upper right: 3
Bottom right: unused

Picture 14: CAU (Upright position as when built into 6 RU chassis)

CAU CONNECTOR PIN ASSIGNMENT INTERFACE 1

Plug	Interface		Signal	Line colour	Row	Contact
1	Free			white	A	2
	Free			brown	C	2
	Free			green	A	4
	Free			yellow	C	4
	Free			grey	A	6
	Free			pink	C	6
	Free			blue	A	8
	Free			red	C	8
	Free			black	A	10
	Free			violet	C	10
	Free			grey/pink	A	12
	Free			red/blue	C	12
	Free			white/green	A	14
	Free			brown/green	C	14
	Free			white/yellow	A	16
	Free			yellow/brown	C	16
2	BRA	1	Transmit A	white	A	18
	BRA		Transmit B	brown	C	18
	BRA		Receive A	green	A	20
	BRA		Receive B	yellow	C	20
	BRA	2	Transmit A	grey	A	22
	BRA		Transmit B	pink	C	22
	BRA		Receive A	blue	A	24
	BRA		Receive B	red	C	24
	BRA	3	Transmit A	black	A	26
	BRA		Transmit B	violet	C	26
	BRA		Receive A	grey/pink	A	28
	BRA		Receive B	red/blue	C	28
	BRA	4	Transmit A	white/green	A	30
	BRA		Transmit B	brown/green	C	30
	BRA		Receive A	white/yellow	A	32
	BRA		Receive B	yellow/brown	C	32

CAU CONNECTOR PIN ASSIGNMENT INTERFACE 2+3

Plug	Interface		Signal	Line colour	Row	Contact
1	BRA	5	Transmit A	white	A	2
	BRA		Transmit B	brown	C	2
	BRA		Receive A	green	A	4
	BRA		Receive B	yellow	C	4
	BRA	6	Transmit A	grey	A	6
	BRA		Transmit B	pink	C	6
	BRA		Receive A	blue	A	8
	BRA		Receive B	red	C	8
	BRA	7	Transmit A	black	A	10
	BRA		Transmit B	violet	C	10
	BRA		Receive A	grey/pink	A	12
	BRA		Receive B	red/blue	C	12
	BRA	8	Transmit A	white/green	A	14
	BRA		Transmit B	brown/green	C	14
	BRA		Receive A	white/yellow	A	16
	BRA		Receive B	yellow/brown	C	16
2	BRA	9	Transmit A	white	A	18
	BRA		Transmit B	brown	C	18
	BRA		Receive A	green	A	20
	BRA		Receive B	yellow	C	20
	BRA	10	Transmit A	grey	A	22
	BRA		Transmit B	pink	C	22
	BRA		Receive A	blue	A	24
	BRA		Receive B	red	C	24
	BRA	11	Transmit A	black	A	26
	BRA		Transmit B	violet	C	26
	BRA		Receive A	grey/pink	A	28
	BRA		Receive B	red/blue	C	28
	BRA	12	Transmit A	white/green	A	30
	BRA		Transmit B	brown/green	C	30
	BRA		Receive A	white/yellow	A	32
	BRA		Receive B	yellow/brown	C	32

2.6.6 CAU2

Article number: 1F5019

The CAU2 (Carrier Unit two) is a hardware device, which can be used in the NovaTec systems S5+, S6, S6+, S7, S20, S20+ and S21 and serves as carrier unit for NovaTec daughter board boards. She is the replacement of the CAU board. In the process of modernising also measures have been taken to cut costs and improve the connection technology.

CAU2 has three slots for daughter boards.

Depending on the assembly the CAU2 can provide for the following amount of interfaces:

- PRI boards: 6 interfaces (with CCU4/ CCU6 only two PRI interfaces)
- BRI or Uk0 boards: 12 interfaces
- ANA4 boards: 12 interfaces

Picture 15: CAU2 (lateral position as when built in 3 RU chassis)

Daughter board (1-3)	LED (1-8)		Meaning
Daughter board-x	LED-1 (green)	on	Interface-1: L1 active
	LED-1 (green)	off	Interface-1: L1 inactive
Daughter board-x	LED-2 (yellow)	on	Daughter board identified.
	LED-2 (yellow)	off	Daughter board identified.
Daughter board-x	LED-3 (green)	on	Interface-2: L1 active
	LED-3 (green)	off	Interface-2: L1 inactive
Daughter board-x	LED-4 (yellow)	on	Meaningless.
	LED-4 (yellow)	off	Meaningless.
Daughter board-x	LED-5 (green)	on	Interface-3: L1 active
	LED-5 (green)	off	Interface-3: L1 inactive
Daughter board-x	LED-6 (yellow)	on	Meaningless.
	LED-6 (yellow)	off	Meaningless.
Daughter board-x	LED-7 (green)	on	Interface-4: L1 active
	LED-7 (green)	off	Interface-4: L1 inactive
Daughter board-x	LED-8 (yellow)	on	Meaningless.
	LED-8 (yellow)	off	Meaningless.

Picture 16: CAU2 (Upright position as when built into 6 RU chassis)

Application	1	2	3	4	5	6	7	8
U_{P0}, U_{K0}, U_0				1a	1b			
Analogue telephone				a	b			
ISDN BRI			2a	1a	1b	2b		
ISDN PRI (E1)			Rx	Tx	Tx	Rx		

Picture 17: CAU2 view from above

2.6.7 BCU

Article number: 1F7001, 1F7002, 1F7003

EoP, stock may still be available.

The BCU (B Channel Unit) is a hardware device, which can be used in the NovaTec systems S5+, S6, S6+, S7, S20, S20+ and S21 and contains the DSPs for codec functions within the system.

For the transmission of the RTP/sRTP data the BCU holds its own Ethernet interface and controller as well as its own processor for the control of the board and the encryption of the RTP data in sRTP. The BCU module was replaced by CCU4/CCU6.

BCU is available in three versions with the corresponding amount of DSPs on board:

- BCU8 has 8 DSPs
- BCU16 has 16 DSPs
- BCU32 has 32 DSPs

In sRTP mode only up to 15 sRTP channels can be used simultaneously due to the required CPU performance in the BCU. This means 100% utilisation for BCU8, approx. 94% for BCU16 and for BCU32 approx. 47% utilisation.

LED displays   Ethernet socket

Picture 18: BCU (lateral position as when built into 3 RU chassis)

LED display / functions		
1	0,5 seconds flashing	BCU not configured
1	1 seconds flashing	BCU configured and identified (ready for use)
2	on	BCU energised
2	off	No power supply existent

LED 1

Picture 19: BCU (upright position as when built into 6 RU chassis)

2.6.8 ULU

Article number: 1F5010-3

EoP, stock may still be available.

The ULU is a hardware device, which can be used in the NovaTec systems S5+, S6, S6+, S7, S20, S20+ and S21 depending on the firmware version. The module provides 4 U interfaces including phantom line power. Terminal equipment with U interfaces or standard NTs with a 2B1Q line code can be connected to this module. The ULU module is replaced by U0 daughter boards.

Picture 20: ULU (lateral position as when built into 3 RU chassis)

Picture 21: ULU (upright position as when built into 6 RU chassis)

ULU CONNECTOR PIN ASSIGNMENT

Plug	Interface		Line	Signal	Line colour	Row	Contact
1	U	**1**	**1**	Wire **A**	white	A	2
	U			Wire **B**	brown	C	2
	free				green	A	4
	free				yellow	C	4
	U	**2**	**2**	Wire **A**	grey	A	6
	U			Wire **B**	pink	C	6
	free				blue	A	8
	free				red	C	8
	U	**3**	**3**	Wire **A**	black	A	10
	U			Wire **B**	violet	C	10
	free				grey/pink	A	12
	free				red/blue	C	12
	U	**4**	**4**	Wire **A**	white/green	A	14
	U			Wire **B**	brown/green	C	14
	free				white/yellow	A	16
	free				yellow/brown	C	16
2	free	**5**	**1**		white	A	18
	free				brown	C	18
	free				green	A	20
	free				yellow	C	20
	free	**6**	**2**		grey	A	22
	free				pink	C	22
	free				blue	A	24
	free				red	C	24
	free	**7**	**3**		black	A	26
	free				violet	C	26
	free				grey/pink	A	28
	free				red/blue	C	28
	free	**8**	**4**		white/green	A	30
	free				brown/green	C	30
	free				white/yellow	A	32
	free				yellow/brown	C	32

2.6.9 DC4

Article number: 1F4080

EoP, stock may still be available.

The DC4 (DC provision of 40 volts +5%/-15%) is a hardware device, which can be used in the NovaTec systems S5+, S6, S6+, S7, S20, S20+ and S21 and is only necessary within the system if the BRI interfaces in the system need feeding with 42 volt phantom powering (only with BRI boards of older versions up to article number 1F5020-P and 1F5021-5 necessary).

The use of multiple DC4 in one system to increase the power output is possible. Every DC4 provides up to 16 watts power output. DC4 is neither needed nor used for the Uk0 daughter board (1F5010-6) and the new BRI boards (1F5020-7P, 1F5020-8P and 1F5020-11).

Picture 22: DC4 (lateral position as when built into 3 RU chassis)

Picture 23: DC4 (upright position as when built into 6 RU chassis)

2.6.10   PRI daughter board

Article number: 1F5100R

The PRI daughter board has two independent PRI (primary rate interface) interfaces. These interfaces can be configured as master or slave. The PRI interfaces can be operated symmetrically with 120 ohm (factory setting) or asymmetric with 75 ohm.

The corresponding impedances can be set via the sliding switches (see below).

SLIDING SWITCHES 1 & 2		
Switch 1 state*		**Effect**
1	off	Line 1: 120R symmetric
2	off	
1	on	Line 1: 75R asymmetric
2	on	
Switch 2 state*		**Effect**
1	off	Line 1: 120R symmetric
2	off	
1	on	Line 1: 75R asymmetric
2	on	

*The switch positions as described above are to be understood as „&" connections between switches 1 and 2. The same settings and „&" connections from the table above apply to the switches 3 and 4 for line 2.

2.6.11 BRI/Up0 daughter board

Article number: BRI: 1F5020-8 and 1F5020-9 / Up0: 1F5010-8 and 1F5010-9

EoP, stock may still be available.

The daughter boards 1F5020-8 and 1F5020-9 are successor models of the BRI daughter boards 1F5021-2 and 1F5020-P and have comparable functions. **Attention**: The proper daughter board type has to be selected within the configuration.

The daughter board has four independent So (Basic rate interfaces) or four U_{p0} two-wire interfaces. These interfaces can be set into master or slave mode and in master mode can be set in point to multi point or point-to-point mode (for S_0 interface only) via the configuration.

When used in a RMCS server the daughter boards have to be configured as slave and when used in a RMCS client they have to be configured as master.

The S_0 BRI interfaces can be used with or without terminating resistor (necessary depending on the topology of the bus). The corresponding terminating resistors can be switched on or off with the sliding switches on board (see below).

Depending on the application the BRI/Up0 daughter board is available in different versions with or without BRI/Up0 phantom line power unit.

LEFT SLIDING SWITCH / TERMINATING RESISTORS		
Switch and state		**Effect**
1-2	on	Line 1: 100R on
3-4	on	Line 2: 100R on
RIGHT SLIDING SWITCH / TERMINATING RESISTORS		
Switch and state		**Effect**
1-2	on	Line 3: 100R on
3-4	on	Line 4: 100R on

Left sliding switch

on
off

| 1 | 2 | 3 | 4 |

Right sliding switch

| 1 | 2 | 3 | 4 |

The following boards with article numbers 1F5020-7P (BRI S_0 board) and 1F5010-7P (Up0 board) are technological advanced in comparison to their predecessors' 1F5020-8/ 1F5020-9 (BRI S_0 boards) and 1F5010-8/ 1F5010-9 (Up0 boards). These new boards make the use of DC4 in the system for the feeding of the BRI and Up0 interfaces superfluous. All other functions are fully equal to their predecessors.

U_{P0} board (1F5010-7P)

BRI S_0 board (1F5020-7P)

Article numbers: 1F5020-P and 1F5021-2

EoP, stock may still be available.

The BRI daughter board has four independent BRI (basic rate) interfaces. These interfaces can be set into master or slave mode or point-to-multipoint or point-to-point connection via the configuration. The maximum amount of BRI interfaces, which can be fitted into the system, can be determined with the configurator available from NovaTec.

The BRI S_0 interfaces can be used with or without terminating resistors (necessary depending on the topology of the bus). The corresponding terminating resistors can be switched on or off with the sliding switches on board (see below).

Depending on the application the BRI daughter board is available in different versions with or without BRI phantom line power unit.

LEFT SLIDING SWITCH / TERMINATING RESISTORS		
Switch and state		Effect
1-2	on	Line 1: 100R on
3-4	on	Line 2: 100R on
RIGHT SLIDING SWITCH / TERMINATING RESISTORS		
Switch and state		Effect
1-2	on	Line 3: 100R on
3-4	on	Line 4: 100R on

2.6.12 U₀ daughter board

Article numbers: 1F5010-5 and 1F5010-6

The U_0 daughter board has four independent U_0 basic rate interfaces. The maximum amount of U_0 interfaces, which can be fitted into the system, can be determined with the configurator available from NovaTec.

The U_0 interfaces are available with line code 2B1Q or 4B3T depending on the article number and can be delivered as version with or without line power units on board. These boards can only be used as subscriber or master trunk line.

The U_0 daughter boards are serviceable from firmware 00.08.03.xx and NMP 00.07.03.xx on and can be used with CCU3, CCU4, CCU6, CAU or CAU2.

2.6.13 ANA4 daughter board

Article number: 1F5020-5

The ANA4 daughter board has four independent analogue interfaces. These interfaces may receive different settings via the configuration (see table below).

Analogue interface	• Automatic detection of IWV and MFV (ETSI standards ETSI ES 201 235-1,2 V1.1.1) • Range up to 10.000 m (depending on type of cable) • High bell voltage with up to 5 US REN (Ringer Equivalent Number) in accordance with AT&T / 125 V Peak bell voltage and temperature rise protection • Adaption of line impedance for 15 countries (Austria, Germany, USA, ...) • Caller ID in accordance with Bellcore/Telcordia GR-30-CORE Bell202 FSK CID Coding and ETSI 300-659-1/2/3 V1.3.1 V.23 FSK coding for transmission of CID • Call-charge puls can be configured with 12/16 kHz • Modem standards up to V.90 • Fax standards up to V.34 • Fax/Modem/Voice recognition (Fax/Modem switch)

2.6.14 Feature list SIP gateways

Model	NovaTec S5+	NovaTec S6 / S7	NovaTec S20 / S20+ / S21
Width x Depth x Height	19" Chassis: 480 x 220 x 60 mm Table/Wall housing: 360 x 220 x 60 mm	19" Chassis: 480 x 220 x 135 mm	19" Chassis: 480 x 235 x 265 mm
Weight	2 to 4 kg	7 to 12 kg	7 to 18 kg
Power supply	100 – 240 V~	S6: 100 – 240 V~ S7: -36 to -72 Vdc or 100-240 V~ +/- 10% (50/60 Hz)	S20: 115V~ - 230 V~ +/- 10% S21: -36 to -72 Vdc or 100 – 240 V~ +/- 10%
Max. amount of non-blocking PRI interfaces CCU3: CCU4 / CCU6:	1 4	2 4	2 / 12* 4 / 12*
Multiple blocking PRI interfaces CCU3:	Yes	Yes	Yes
Max. amount of non-blocking BRI interfaces CCU3: CCU4 / CCU6:	8 20	30 (without dial tone) 28 (with dial tone) 56 (with dial tone)	30 / 90* (without dial tone) 28 / 84* (with dial tone) 64 / 168* (with dial tone)
Max. amount of blocking BRI interfaces CCU3:	8	44	100 / 132*
Max. amount of non-blocking U_0 interfaces (ULU) CCU3: CCU4 / CCU6:	0 4	12 16	30 / 36* (without dial tone) 28 / 36* (with dial tone) 56 / 48* (with dial tone)
Max. amount of blocking U_0 interfaces (ULU) CCU3:	0	12	48 / 36*
Max. amount of non-blocking U_{p0}/U_{k0} interfaces (daughter boards) CCU3: CCU4 / CCU6:	8 20	30 (without dial tone) 28 (with dial tone) 56 (with dial tone)	30 / 90* (without dial tone) 28 / 84* (with dial tone) 64 / 168* (with dial tone)
Max. amount of blocking U_{p0}/U_{k0} interfaces (daughter boards) CCU3:	8	44	100 / 132*
Analogue subscriber connection lines in accordance with ITU-T G.712 and Q.552 – non-blocking CCU3: CCU4 / CCU6:	8 20	44 56	60/132* (with/without dial tone) 56 / 132* (with dial tone) 128 / 168* (with dial tone)
Analogue subscriber connection line in accordance with ITU-T G.712 and Q.552 – blocking CCU3:	8	44	196 / 132*
Max. amount of media converters for VoIP CCU3: CCU4 / CCU6:	32 128	128 128	196 / 384* 128
Transparent pass through of ISDN via IP CCU3: CCU4 / CCU6:	Yes	Yes	Yes

Model	NovaTec S5+	NovaTec S6/ S7	NovaTec S20 / S20+/ S21
SIP link with Cisco Call Manager (also for data applications from release 7.1.2 on) **SIP link at ISR** for data applications from IOS 12.4T	Yes	Yes	Yes
SIP (Session Initiation Protocol) • RFC 3261 (UDP, TCP-IP support) • Digest Authentication (RFC2617) • Reliability of provisional responses (RFC3262) • Offer/answer (RFC3264) • STUN client and server (NAT traversal RFC3489) • Firewall NAT routing (fixed tables) • In-Band/Out-of-Band DTMF (RFC2833) • Session timer (RFC4028) • SIP Extensions for caller identity and privacy • SIP media inactivity timer • ITU-T T.38 fax (only CCU-3) • E164 (RFC3824) • DNS name resolution (RFC 1034, 1035) • ENUM (RFC 3761) • HTTP(S) Server for diagnostics, statistics and trace (HTTPS is only supported with NAMES) • SIP Call Features • Hold • Call Transfer • Music on Hold • ISDN Calling Name • 3PTY • Security • sRTP for voice and data (RFC3711) • sRTP Fallback to RTP and RTP to sRTP (configurable) • X505v3 certificates can be loaded, created (RFC 5280)	Yes	Yes	Yes
Link to SMS centre via SMPP CCU3: CCU4 / CCU6:	Yes No	Yes No	Yes No
Subscriber individual budget assignment with barring of subscriber when budget is exhausted CCU3: CCU4 / CCU6:	Yes No	Yes No	Yes No
Emailing incl. CLIP information if mobile, fixed network or IP telephone are not available (direct call back possible) CCU3: CCU4 / CCU6:	Yes No	Yes No	Yes No
Offer/Answer model with Session Description Protocol (SDP)	Yes	Yes	Yes
Proxy usage (outgoing call)	Yes	Yes	Yes
Error configuration via ISDN & IP CCU3: CCU4 / CCU6:	Yes Only via IP	Yes Only via IP	Yes Only via IP
Hold and off hold and call forwarding	Yes	Yes	Yes
Forwarding when occupied, non-availability and fixed call forwarding	Yes	Yes	Yes
Parallel and sequential forking: Collective line without waiting loop	Yes	Yes	Yes
Re-INVITE: Codec change, hold, call waiting, session timer	Yes	Yes	Yes
Supported header field "Supported"	Yes	Yes	Yes
Telephone number assignment	Yes	Yes	Yes

Model	NovaTec S5+	NovaTec S6/ S7	NovaTec S20 / S20+/ S21
One uniform telephone number for mobile, fixed network and IP telephone	Yes	Yes	Yes
ISDN cause codecs in the call data	Yes	Yes	Yes
SIP cause codecs in the call data	Yes	Yes	Yes
T.38 fax Fax over IP in accordance with ITU-T recommendation T.38 and Annex D CCU3: CCU4 / CCU6:	Yes	Yes	Yes
Codec and voice compression • G.711 incl. Annex I (BFI) and Annex II (VAD/CNG) aLaw & uLaw; • G.726 incl. VAD/CNG, BFI error concealment and payload support RTP in accordance with "RFC 3551" • G.728, 16 kbit/s (Only with CCU3) • G.729 A/B, 8 kbit/s • Fax Relay, T.38 Support V.21, V.27ter, V.29 and V.17 (Only with CCU3) • 30 ms voice packet size (all codecs, sending direction) • CCU3: Adaptive / fixed Jitter Buffer max. 200 msec • CCU4: Adaptive Jitter Buffer max. 180 msec, fixed Jitter Buffer max. 300 msec • Jitter Buffer inbound modem support • RTP/SRTP protocol support in accordance with RFC3550 and RFC3711 • Payload Byte Counter (H248.1 Annex E) • X-CCD & clear mode for data transfer • Silence Compression • Comfort Noice Generation	Yes	Yes	Yes
Analogue signalling: • The „Near Line Echo Canceller" (16 msec) is compatible with valid ITU-T G.165 and G.168 standards. • Caller ID Sender (CIDS), V.23 and Bel202 • Caller ID Receiver (CIDR), V.23 and Bel202 • DTMF/AT generator • DTMF receiver (DTMFR) according to ITU-T Q.23. • Universal Tone Generator (UTG) • Universal Tone Detector (UTD) according to ITU-T V.8 • Text Phone V.18 A Detector • Call Progress Tone Detector (CPTD) • Answering Tone Detector (ATD) • Digital Identification Signal (DIS) V.21 Detector • DTMF Event Support according to RFC2833	Yes	Yes	Yes
VLAN (Virtual LAN) according to 802.1Q	Yes	Yes	Yes
MD5 authentication	Yes	Yes	Yes
NAT assignment tables	Yes	Yes	Yes
STUN Server/Client	Yes	Yes	Yes
HTTP diagnoses interface	Yes	Yes	Yes
User accounting	Yes	Yes	Yes
Remote diagnostics	Yes	Yes	Yes
Local time from ISDN	Yes	Yes	Yes
NTP: UTC server query for automatic time setting	Yes	Yes	Yes
Summer / Winter time	Yes	Yes	Yes
Static IP / dynamic IP	Yes	Yes	Yes

Model	NovaTec S5+	NovaTec S6/ S7	NovaTec S20 / S20+/ S21
Basic & Supplementary Call Set Up	Yes	Yes	Yes
Session timer according to IETF internet concept: ietf sip session timer-04.txt	Yes	Yes	Yes
Support of public and private IP addresses for use with NAT firewalls	Yes	Yes	Yes
Configurable SIP and RTP connections	Yes	Yes	Yes
Encryption (SRTP) AES 128 (Activation by NovaTec necessary)	Yes	Yes	Yes
Encryption (TLS): Activation by NovaTec necessary: - TLS1.0 / SSL3.0 according to RFC2246 - RC2, RC4 DES and AES according to RFC3268 - X509v3 certificates according to RFC3647 - RSA key exchange for asymmetric crypto systems	Yes	Yes	Yes
SNMP - Presently SNMP-V1 and SNMP-V2C without traps are supported. - With SNMP Mapper additionally SNMP-V3 and V3-Traps are supported.	Yes	Yes	Yes
Ethernet 802.3 CCU3: 10 BASE-T & 100 BASE-TX CCU4: 10 BASE-T,100 BASE-TX & 1000 BASE-TX CCU6 : CCU4 spec. Plus one SFP interface	Yes Yes	Yes Yes	Yes Yes
Ethernet half duplex	Yes	Yes	Yes
Ethernet complete duplex	Yes	Yes	Yes
GPS receiver for synchronisation CCU3: CCU4 / CCU6:	Optional No	Optional No	Optional No
Synchronisation via RMCS	Optional	Optional	Optional
RMCS server functionality	Optional	Optional	Optional

*only with S20+ (with 3x S6 back plane)

2.6.15 Technical data sheet SIP gateways

Mechanical data	S5+	S6+/ S7	S20 / S20+/ S21
Width x Depth x Height	19" chassis: 480 x 220 x 60 mm Table / Wall housing: 365 x 220 x 60 mm	19" chassis: 480 x 250 x 135 mm	19" chassis: 480 x 235 x 265 mm
Rack units	1,5 RU	3 RU	6 RU
Weight (depending on expansion step)	2 up to 4 kg	7 up to 12 kg	7 up to 18 kg
Mounting method	Screw joint in 19" cabinet S5+ wall housing: wall mounting		
System structure	Modular structure of slide-in module an daughter boards		
Electric data	**S5+**	**S6+/ S7**	**S20 / S20+/ S21**
Power supply, non-redundant			
Provision of electricity	100 – 240 V~ 50 up to 60 Hz		
Power input	0,7 **A~**, 42 up to 80 **VA**		
Power supplies; redundancy capable			
Provision of electricity per power supply	---	S6+: 115 – 230 V~ S7: -36 up to -72 Vdc or 100-240 V~ +/- 10% (50/60 Hz)	S20, S20+: 115 – 230 V~ S21: -36 up to -72 Vdc or 100-240 V~ +/- 10% (50/60 Hz)
Power input	---	S6+: Nominal: 135 VA Max.: 210 VA S7: max. 4A at 230V~ and 8A at 110 V~ and max. 32A at -48V	S20, S20+: Nominal: 380 VA Max.: 427 VA S21 with 4 power supplies: max. 8A at 230V~ and 16A at 110 V~ and max. 64A at -48V
Characteristics	• Frontal power connector	• Temperature controlled fan in the front plate • Integrated active current sharing of the power supplies • Frontal power connector	
Power connector	Rubber connector (IEC 320)	With AC power supplies: Rubber connector (IEC 320) With DC power supplies: Connector enclosed.	With AC power supplies: Rubber connector (IEC 320) With DC power supplies: Connector enclosed.
Earth	Separate earth via earth cable with min. 2,5 mm^2 section		
Overvoltage protection	Internal surge protection		
Available interfaces (depending on system setup)	• 1 x V.24 (CCU3) • 1 x USB (CCU4) • 1 x Ethernet according to IEEE 802.3/802.3u (CCU3, MCU, V4U and BCU) • 2 x Ethernet according to IEEE 802.3/802.3u/802.3ab/802.3x (CCU4 / CCU6) • ISDN BRI, EDSS1 (insertable on all CCU3/4/5, MCU, V4U and CAU/ CAU2) • ISDN PRI, EDSS1 (insertable on all CCU3/4/5, MCU, V4U and CAU/ CAU2) • ISDN U_0 or Upo, EDSS1 (insertable on all CCU3/4/5, MCU, V4U and CAU/CAU2) • Analogue interfaces (insertable on all CCU3/4/5, MCU, V4U and CAU/CAU2) • GSM (only insertable on CCU3 and MCU)		

Electric data	S5+	S6+/ S7	S20 / S20+/ S21
BRI interface	- According to CTR 3, TBR 3, ITAAB - Feeding S5+: 0 V or externally with the USS (feeding unit) - Feeding S6, S20/S20+: 40 V, 50 mA when using DC4 modules 0 V without DC4 module - Range: max. 220 m (passive bus) max. 900 m (advanced passive bus) max. 1000 m (point to point)		
PR interface	- According to CTR 4 A1, 98/520/EG - Range: max. 1000 m with use of a 0,6 mm cable		
U0 interface (ULU module)	- According to ANSI T1.601, CTR 3, TBR 3 (2B1Q) - Feeding S5+: 0 V - Feeding S6, S20/S20+: 0 V or 110 V ± 5 V, 25 mA (depending on module) - Range: max. 8000 m with use of a 0,6 mm cable - Max. allowed cable attenuation: 40 dB/40 kHz		
U0 interface (U0 daughter board)	- According to ANSI T1.601, CTR 3, TBR 3 (2B1Q) - If feeding is available: 72 V ± 5 V, 30 mA - Range: max. 8000 m with use of a 0,6 mm cable - Max. allowed cable attenuation: 40 dB (80 kHz)		
Uk0 interface (Uk0 daughter board)	- According to ETSI TS 102 080 V1.3.1 (1998), ITU-T G.961 (1995) (4B3T) - If feeding is available: 72 V ± 5 V, 30 mA - Range: max. 6000 m with use of a 0,6 mm cable - Max. allowed cable attenuation: 35 dB (120kHz)		
Up0 interface	- Electronic Manufacturing Industry Association of Germany, Information & Communication Technology Group (ZVEI Zentralverband Elektrotechnik, Fachverband Informations- und Kommunikationstechnik (I+K Forum)). *ZVEI Documentation DKZ-N; Interfaces and signaling protocols for ISDN telecommunication installations. (Only available in German under title: ZVEI Dokumentation DKZ-N; Schnittstellen und Signalisierungsprotokolle für Telekommunikationsanlage im ISDN)*, Mai 1989. Volume IV: DKZ-N part 1.2, DKZ-N2 part 2.2. - The transmission via this interface is executed in half-duplex operation. - Feeding: 40 V, 50 mA with use of the DC4 module or on board power unit 0 V without DC4 module - Range: ca. 2 up to 4 km		
Analogue interface	- Automatic detection of IWV and MFV (ETSI standards ETSI ES 201 235-1,2 V1.1.1) - Range up to 10.000 m (depending on cable type) - High bell voltage with up to 5 US REN (Ringer Equivalent Number) in accordance with AT&T / 125 V Peak bell voltage and overvoltage protection - Adjustment of line impedance for 15 countries (Austria, Germany, USA, ...) - Caller ID according to Bellcore/Telcordia GR-30-CORE Bell202 FSK CID coding and ETSI 300-659-1/2/3 V1.3.1 V.23 FSK coding for transfer of CID. - Call-charge pulse at 12/16 kHz configurable. - Modem standards up to V.90 - Fax standards up to V.34 - Fax/Modem/Voice recognition (Fax/Modem switch)		
GSM interface (only insertable on CCU3 and MCU)	- GSM classification Small MS - Dual band EGSM900 and GSM 1800 (GSM phase 2+) - Class 4 (2W) for EGSM900 - Class 1 (1W) for GSM1800 - Half Rate (ETS 06.20), Full Rate (ETS 06.10) - Extended Full Rate (ETS 06.50 / 06.60 / 06.80) - Output: 900 MHz = 2 Watt - Output: 1800 MHz = 1 Watt - Voice codec		

Electric data	S5+	S6+/ S7	S20 / S20+/ S21
IP interface	• SIP 2.0 → RFC3261 ITU V.110 → Data interface between ISDN, IP and GSM (GSM only with CCU-3) • TLS and sRTP		

Clock accuracy CCU3	• Worst Case: +/- 50ppm
	• Temp. Drift: +/- 25 ppm at -20°C up to +70°C
	• Pull Range: +/- 100 ppm
	• Clock accuracy with RMCS option:
	    - Measured over a longer period (2 days): +/- 0.5 ppm (5 * 10-7)
	    - Worst Case view and warranted: +/- 5 ppm (5 * 10-6)		

Clock accuracy CCU4/ CCU6	• Worst Case: +/- 2ppm at 0°C up to +40°C
	• Pull Range: +/- 100 ppm
	• Clock accuracy with RMCS option:
	  - Measured over a longer period (2 days): +/- 0.5 ppm (5 * 10-7)
	  - Worst Case view and warranted: +/- 5 ppm (5 * 10-6)		

Encryption (only SIP gateways)	• SRTP according to RFC3711 and RFC4711 (AES-CM-128 / HMAC-SHA1-32)
	• TLS version 1.0 according to RFC2246 and RFC3268 and TLS1.2
	  Key Agreement: RSA and Diffie Hellmann
	  Cipher suite: AES, DES and 3DES
	  Certificate: X509v3
	  Hash functions : SHA and MD5		

Codec and voice compression	• G.711 incl. Annex I (BFI) and Annex II (VAD/CNG) • G.726 incl. VAD/CNG, BFI Error Concealment and Payload Support RTP according to "RFC 3551" • G.728, 16 kbit/s (only with CCU3) • G.729 A/B, 8 kbit/s • Fax Relay, T.38 Support V.21, V.27ter, V.29 and V.17 (only with CCU3) • 10, 20 and 30 ms voice packet size (all Codecs, sending direction) configurable • CCU3: Adaptive / Fixed Jitter Buffer max. 200 msec • CCU4: Adaptive Jitter Buffer max. 180 msec, Fixed Jitter Buffer max. 300 msec • Jitter Buffer Inbound modem support • RTP/SRTP Protocol support according to RFC3550 and RFC3711 • Payload Byte Counter (H248.1 Annex E) • X-CCD & Clear mode for data transmission • Silence compression • Comfort Noise Generation		
Analogue signalising	• The Near Line Echo Canceller (16 msec) is compatible with valid ITU-T G.165 and G.168 standards. • Caller ID Sender (CIDS), V.23 and Bel202 • Caller ID Receiver (CIDR), V.23 and Bel202 • DTMF/AT generator • DTMF Receiver (DTMFR) according to ITU-T Q.23. • Universal Tone Generator (UTG) • Universal Tone Detector (UTD) according to ITU-T V.8 • Text Phone V.18 A Detector • Call Progress Tone Detector (CPTD) • Answering Tone Detector (ATD) • Digital Identification Signal (DIS) V.21 Detector • DTMF Event support according to RFC2833		

Surrounding conditions	S5+	S6+/ S7	S20 / S20+/ S21
Storage and transport	-20° C up to +90° C 0% up to 95% humidity (non-condensing)		
Operation	+10° C up to +40° C 0% up to 95% humidity (non-condensing)		
Heat emission (using non-redundant power supplies)	115 kJ / 32 Wh		
Heat emission (using redundancy capable power supplies)	---	S6+: Nominal: 205 kJ / 57 Wh Max.: 837 kJ / 233 Wh S7: Nominal (one AC power supply): 3308 kJ / 920Wh Max. (two DC power supplies): 4138 kJ / 1152 Wh	S20, S20+: Nominal: 335 kJ / 93 Wh Max.: 2360 kJ / 656 Wh S21: Nominal: (two AC power supplies): 6616 kJ / 1840 Wh Max. (four DC power supplies): 8276 kJ / 2304 Wh

2.7 System family in non-modular design and their limits

All NovaTec systems in a table / wall housing of the S3 family are non-modular and consist basically of one assembled printed circuit board. The assembly depends on the defined version and is made identifiable by the label on the on the back (order number) and the connector array on the front:

2.7.1 S3 versions

The table below shows all available versions and system limits depending on the assembly:

Order no.	Article description	Application
1F8000R	NovaTec S3 (2x BRI / 4x Codecs / RMCS)	Access Media Gateway (SIP Gateway)*
1F8000RQ	NovaTec S3 (2x BRI / 4x Codecs / RMCS + HEQ)	Access Media Gateway (SIP Gateway) with precision quartz**
1F8020R	NovaTec S3 (2x BRI / 2x analogue / 4x Codecs / RMCS)	Access Media Gateway (SIP Gateway)*
1F8020RQ	NovaTec S3 (2x BRI / 2x analogue / 4x Codecs / RMCS + HEQ)	Access Media Gateway (SIP Gateway) with precision quartz**

*Incl. synchronisation unit for RMCS

** The synchronisation of the NovaTec gateways with RMCS is a dynamical process and is only established for the duration of an appropriate data connection. During the non-connection period of time or during voice calls, there will not be any synchronisation in place or established. During these times the NovaTec gateways run with their internal quartz clock and provide the same clock accuracy to all units connected to them. In some network constellations, the units connected to the NovaTec systems require a certain minimum of clock accuracy at any time (for example PABXs with DECT subscribers). For these network constellations S3 unit versions 1F8000RQ and 1F8020RQ should be used. If S5+ to S21 with CCU3 are in use, BCU versions with 1Hz precision clock source should be used.

⚠ **Attention**: In all RMCS versions of the S3 only three B channels are available if you are using the RMCS option.

2.7.2 Feature list S3 / Cisco VG-2BRI-R

Features	
Width x Breadth x Depth	Table or wall housing: 211 x 155 x 40 mm
Weight	1 up to 2 kg
Power supply	90 up to 264 V~
PRI interfaces	No
Max. amount of non-blocking BRI interfaces	2
Max. amount of analogue subscriber lines (optional) according to ITU-T G.712 and Q.552	2
Max. amount of U$_{P0}$ interfaces (optional)	2
Amount of media converters for VoIP	4
Transparent pass-through of ISDN via IP	Yes
SIP (Session Initiation Protocol) • RFC 3261 (UDP, TCP-IP support) • Digest Authentication (RFC2617) • Reliability of provisional responses (RFC3262) • Offer/answer (RFC3264) • STUN client and server (NAT traversal RFC3489) • Firewall NAT routing (fixed tables) • In-Band/Out-of-Band DTMF (RFC2833) • Session timer (RFC4028) • SIP Extensions for caller identity and privacy • SIP media inactivity timer • ITU-T T.38 fax • E164 (RFC3824) • DNS name resolution (RFC 1034, 1035) • ENUM (RFC 3761) • HTTP(S) Server for diagnostics, statistics and trace • SIP Call features • Hold • Call Transfer • Music on Hold • ISDN Calling Name • Security • sRTP for voice and data (RFC3711) • sRTP fall back to RTP and RTP to sRTP (configurable) • X505v3 certificates can be loaded, created (RFC 5280)	Yes
SIP connection to Cisco Communication Manager from release 7.1.2 as Cisco End-Device and to Cisco ISR for data and voice applications	Yes
Subscriber individual budget assignment with barring of subscriber when budget is exhausted	Yes
Emailing incl. CLIP information if mobile, fixed network or IP telephone are not available (direct call back possible)	Yes
Offer/Answer model with Session Description Protocol (SDP)	Yes
Proxy use (out-bound call)	Yes
Remote configuration via ISDN & IP	Yes
Hold and off hold and call forwarding	Yes
Forwarding when busy, not available and fixed call forwarding	Yes
Parallel and sequential forking: Collective line without waiting line	Yes
Re-INVITE: Codec change, hold, call waiting, session timer	Yes
Supported header field "Supported"	Yes
Telephone number assignment	Yes

Features	
One uniform telephone number for mobile, fixed network and IP telephone	Yes
ISDN cause codes in the call data	Yes
SIP cause codes in the call data	Yes
T.38-Fax: Fax over IP according to ITU-T recommendation T.38 and Annex D	Yes
Codec- and voice compression • G.711 incl. Annex I (BFI) and Annex II (VAD/CNG) • G.726 incl. VAD/CNG, BFI Error Concealment and Payload Support RTP according to "RFC 3551" • G.728, 16 kbit/s • G.729 A/B, 8 kbit/s • Fax Relay, T.38 Support V.21, V.27ter, V.29 and V.17 • 30 ms Voice Packet Size (all codecs, sending direction) • Adaptive / Fixed Jitter Buffer max. 200 msec • Jitter Buffer Inbound modem support • RTP/sRTP protocol support according to RFC3550 and RFC3711 • Payload Byte Counter (H248.1 Annex E) • X-CCD & Clear mode for data transmission • Silence Compression • Comfort Noice Generation	Yes
Analogue Signalling: • The near line echo canceller (16 msec) is compatible with valid ITU-T G.165 and G.168 standards. • Caller ID Sender (CIDS), V.23 and Bel202 • Caller ID Receiver (CIDR), V.23 and Bel202 • DTMF/AT generator • DTMF Receiver (DTMFR) according ITU-T Q.23. • Universal Tone Generator (UTG) • Universal Tone Detector (UTD) according to ITU-T V.8 • Text Phone V.18 A Detector • Call Progress Tone Detector (CPTD) • Answering Tone Detector (ATD) • Digital Identification Signal (DIS) V.21 Detector • DTMF event support according to RFC2833	Yes
VLAN (Virtual LAN) according to 802.1Q	Yes
MD5 authentication	Yes
NAT assignment tables	Yes
STUN Server/Client	Yes
HTTP diagnoses interface	Yes
User Accounting	Yes
Remote diagnoses	Yes
Local time from ISDN	Yes
NTP: UTC server query for automatic time adjustment	Yes
Summer / Winter time	Yes
Static IP / dynamic IP	Yes
Basic & Supplementary Call Set Up	Yes
Session timer in accordance with IETF Internet concept: *ietf sip session timer-04.txt*	Yes
Support of public and private IP addresses for use with NAT firewalls	Yes
Configurable SIP and RTP connections	Yes
Encryption (SRTP) AES 128 (Activation by NovaTec necessary)	Yes
Encryption (TLS) (Activation by NovaTec necessary) • TLS1.0 / SSL3.0 according to RFC2246 • RC2, RC4 DES and AES according to RFC3268 • X509v3 certificates according to RFC3647 • RSA key exchange for asymmetric crypto systems	Yes

Features	
SNMP • Currently SNMP-V1 and SNMP-V2C without traps are supported. • With SNMP mapper additionally SNMP-V3 and V3 traps are supported.	Yes
Ethernet 802.3 (10 BASE-T & 100 BASE-TX)	Yes
Ethernet half duplex	Yes
Ethernet full duplex	Yes
Synchronisation via RMCS	Only 1F8000R
RMCS server function	Only 1F8000R

*Only S3 with synchronisation unit for RMCS

2.7.3 Technical data sheet S3 / Cisco VG-2BRI-R

Mechanical data	
Breadth x Depth x Height	Table /Wall housing: 211 mm x 155 mm x 40 mm
Weight	1 up to 2 kg (depending on set up)
Mounting method	Table housing, alternatively wall mounting
System structure	Various options
Electric data	
Power supply	Desktop power pack: 90 up to 264 V~ ; 47 up to 63 Hz
Power input	max. 1 A an 230 V~
Power connection	Rubber connector (IEC 320)
Overvoltage protection	Internal surge protector
Available interfaces (Depending on set-up)	• Serial via USB • 1 x Ethernet according to IEEE 802.3/802.3u • ISDN BRI, EDSS1 • ISDN U_{P0}, EDSS1* • Analogue*

BRI interface	• According to CTR 3, TBR 3, ITAAB
	• Feeding: externally with USS (Feeding unit)
	• Range: max. 220 m (passive bus)
	                    max. 900 m (extended passive bus)
	                    max. 1000 m (point to point)

Analogue interface*	• Automatic detection of IWV and MFV (ETSI standards ETSI ES 201 235-1,2 V1.1.1) • Range up to 10.000 m (depending on type of cable) • High bell voltage with up to 5 US REN (Ringer Equivalent Number) according to AT&T / 125 V Peak bell voltage and overvoltage protection • Adjustment of line impedance for 15 countries (Austria, ..., Germany, ..., USA) • Caller ID according to Bellcore/Telcordia GR-30-CORE Bell202 FSK CID coding and ETSI 300-659-1/2/3 V1.3.1 V.23 FSK coding for transmission of CID. • Call-charge puls of 12/16 kHz configurable. • Modem standards up to V.90 • Fax standards up to V.34 • Fax/Modem/Voice detection (Fax/Modem switch)
IP interface	• SIP 2.0 → RFC3261 • ITU V.110 → Data interface between ISDN, IP and GSM • TLS and sRTP

Electric data	
Clock accuracy	• Worst case: +/- 30 ppm • Temp. drift: +/- 30 ppm at -0°C up to +70°C • Pull range: +/- 100 ppm Clock accuracy with RMCS option: • Measured over a longer period (2 days): +/- 0.5 ppm (5 * 10-7) • Worst Case view and warranted: +/- 5 ppm (5 * 10-6)

Encryption	• SRTP according to RFC3711 and RFC4711 (AES-CM-128 / HMAC-SHA1-32)
	• TLS version 1.0 according to RFC2246 and RFC3268
	  Key agreement: RSA and Diffie Hellmann
	  Cipher suite: AES, DES and 3DES
	  Certificate: X509v3
	  Hash functions: SHA and MD5

Codec- and voice compression	• G.711 incl. annexe I (BFI) and annexe II (VAD/CNG) • G.726 incl. VAD/CNG, BFI error concealment and payload support RTP according to "RFC 3551" • G.728, 16 kbit/s • G.729 A/B, 8 kbit/s • Fax relay, T.38 support V.21, V.27ter, V.29 and V.17 • 10, 20 und 30 ms Voice Packet Size (all codecs, sending direction) configurable • Adaptive /Fixed Jitter Buffer max. 200 msec • Jitter Buffer Inbound Modem Support • RTP/SRTP protocol support according to RFC3550 and RFC3711 • Payload Byte Counter (H248.1 Annex E) • X-CCD & clear mode for data transmission • Silence compression • Comfort Noice Generation
Analogue signalling:	• The near line echo canceller (16 msec) is compatible with valid ITU-T G.165 and G.168 standards. • Caller ID Sender (CIDS), V.23 and Bel202 • Caller ID Receiver (CIDR), V.23 and Bel202 • DTMF/AT generator • DTMF Receiver (DTMFR) according to ITU-T Q.23. • Universal Tone Generator (UTG) • Universal Tone Detector (UTD) according to ITU-T V.8 • Text Phone V.18 A Detector • Call Progress Tone Detector (CPTD) • Answering Tone Detector (ATD) • Digital Identification Signal (DIS) V.21 Detector • DTMF event support according to RFC2833
Surrounding conditions	
Storage and transport	-20° C up to +90° C 0% up to 95% humidity (non-condensing)
Operation	+5° C up to +40° C 0% up to 95% humidity (non-condensing)
Max./Min. temperature	0 up to 40° C
Heat emission	30 J

*not available with TransNova® S3 (Cisco VG2-BRI-R)

2.8 Conception and applications

All NovaTec systems have been optimised for embedded applications and platforms on base of an especially developed multitasking operational software with the name „MOS".

It is intended and always sought to operate all hardware components of various sizes with the same firmware, operation system and maintenance tools or element manager.

Through the conception with modular set-up and the technology of the soft- and hardware diverse applications in the communications sector are possible. The NovaTec systems are not systems with distributed resources but every system has all necessary resources on board. These are deployable as:

- Access Media Gateway in VoIP net works
- GSM gateway
- ISDN multiplexer
- ISDN range extension via IP
- PROXY server
- Clock puls server
- Terminal adapter

2.8.1 NovaTec systems as IP Access Media Gateway

As IP Access Media Gateway the systems are used in the designated place after appropriate configuration. To these belong e.g. all terminal ports to ISDN, GSM or analogue interfaces within an enterprise VoIP network.

All possible options and available characteristics are given in the technical data sheets of the particular systems.

One exemplary connection diagram in an IP network is given in the following picture with a S6 and a S3.

Picture 24: Exemplary connection diagram of IP gateways

ISDN / E1

RTP/SRTP

SIP/SIPs

BRI, U_P0, analogue interfaces

RTP/SRTP

BRI, PRI, U_0, U_P0, analogue interfaces

A-MGWs S6

2.9 Connection technology

2.9.1 Patch panel and configuration

Example: Patch panel (Article number 2F4068) with 6x BRI cables, swivelled (Article number 1F0009N) for use with RMCS server or NLP Unit 1 with CCU3 (With CCU4/ CCU6 and CAU2 all line interfaces are accessible via RJ45 jacks on the front panel).

Picture 25 shows a fully populated patch panel. Depending on the application and the customer's demands the patch panels can be delivered pre-assembled or in parts.

How a patch panel (picture 25) is populated is shown in the following steps.

Picture 25: Fully populated patch panel

Insert the RJ45 jack into the opening of the patch panel with a slight angel from below. The snap-fit should face upwards (Step 1).

Step 1

Press the RJ45 socket upwards until the snap-fit locks into the patch panel (Step 2). You should hear a soft click when this happens.

Step 2

Place the RJ45 clips into the RJ45 sockets from behind after installing these (in the order 1-4) as shown in step 3 and 4.

Mark 1	1. Interface of a daughter board (PRI, BRI, Uko, SUP4, ANA4) or ULU
Mark 2	2. Interface of a daughter board (PRI, BRI, Uko, SUP4, ANA4) or ULU
Mark 3	3. Interface of a daughter board (PRI, BRI, Uko, SUP4, ANA4) or ULU
Mark 4	4. Interface of a daughter board (PRI, BRI, Uko, SUP4, ANA4) or ULU

Step 3

Step 4

In order to fix the cable reel to the patch panel (Step 5) align the reel on one side of the patch panel and insert it into the notch (1). Now press the cable reel down (2). Repeat procedure with cable reel on the other side of the patch panel.

Step 5

To fix the cables to the cable reel use the provided cable ties, as shown in step 6. In order to avoid damage to the cable please do not tighten the cable ties to much.

Step 6

The appropriate population of the different interfaces on the front of the patch panel can be found in the following table:

The eight pins of the sockets are connected through 1:1.

Interface	Type of cable	Population with pin number
Analogue	1F0009	a: 4, b: 5
Uk_0/U_p0	1F0009	a: 4, b: 5
BRI NT mode	1F0009	Ta, Tb: 4,5 and Ra, Rb: 3,6
BRI TE mode	1F0009N	Ta, Tb: 3,6 and Ra, Rb: 4,5
PRI NT mode	1F0008	Ta, Tb: 1,2 and Ra, Rb: 4,5
PRI TE mode	1F0008N	Ta, Tb: 4,5 and Ra, Rb: 1,2

The other end is inserted into the terminal strip of the CCU, CAU or ULU. When inserting the cable into the terminal strip you need to heed the correct direction: Cable to the left with S5+, S6 and S6+ (Picture 26) and upwards with S20 and S20+ (Picture 27). Furthermore you have to position the right resp. lower connectors staggered (with S5+, S6 and S6+ the right connectors and the lower with S20 and S20+). The second connector is flush mounted.

Picture 26: Terminal strip with 1 BRI cable on CCU3, CAU or ULU

Picture 27: Terminal strip with 1 BRI cable on CCU3

3 Tools and applications

In this chapter all available software tools for maintenance, configuration and monitoring of the NovaTec gateways are described. The dependencies to operating software and performance limits are also specified in this chapter.

3.1 NovaTec Maintenance Package (NMP)

The Maintenance Package of NovaTec contains three software packages. The installation files and the corresponding details and release notes can be found under:

http://www.novatec.de/cms/de/Downloads/FirmwareDownloadNMPx.v.y.z.html

The system release versions are described as follows:

X: Stands for major changes. Is incremented when basic or substantial function extensions occur, e.g. new hardware components like CPU or similar.

V: Stands for changes of medium size. Is incremented when larger function extensions occur, that only apply to the software.

Y: Stands for small changes. Is incremented when small function extensions like surface adaptions occur, that only apply to the software.

Z: Stands for a bug fix version and is only incremented when pure fault repairs are carried out.

COMPONENTS OF NMP PACKAGE

NT-Conf: This tool is a Windows application and is used for offline configuration of the NovaTec systems. Amongst other things NT-Conf also performs a plausibility check of the constructed configuration and the manual placement or transfer of the constructed configuration to the NovaTec gateways. The system software approved for can always be found in the corresponding release notes.

TI-C: Trace Info Client is used for trouble shooting, remote firmware update and remote state analysis of the NovaTec gateways. This tool is a Windows application.

CLI: Command Line Interface is based on TI-C and extends this by a CLI access to the target system. The CLI commands allow the control of the call forwarding in the target system amongst other things. CLI is available from Version 6.8.0.3 of TI-C. The commands are executed within the systems from firmware version 00.07.04.00 on.

You will find more detailed information under:

https://www.novatec.de/handbooks/IP-KonfigurationmitCLI%201.3_engl.pdf

Call-Server is a tool for the real time tracking of call states in the NovaTec gateways. This tool is a Windows application.

3.2 NovaTec Administration & Management Element Server (NAMES)

3.2.1 Overview

NAMES provides a web based service for management, provisioning, maintenance and monitoring of NovaTec gateways via IP. With NAMES you can carry out time or event controlled maintenance tasks like the transfer of firmware or configurations onto the systems, reading out call data or traces or issuing of TLS certificates. Besides this, NAMES converts the proprietary call home events of the systems into SNMP traps.

Picture 28: Overview of NAMES

The web interface of NAMES accessible via http/s allows multiple users to add targets (term for a gateway administered by NAMES) simultaneously, depending on the rights set, enter jobs or change or retrieve data. The service is run on a server system and can be used with a web browser on the users PCs without additional software installation. By integrating NAMES as service into the Windows systems software it is automatically

opened when starting the system and does not need any further changes on the server system after the first installation.

The data administered by NAMES is stored in a data base; Oracle DB 11g and MySQL/MariaDB are supported as external data base or an embedded data base with H2.Therefore the entire functionality of an SQL server (backup system, replication etc.) or the comfort of the standard pre-configured internal data base (with regularly automatic backup in the data system) can be used as required.

NAMES is compatible from firmware version 00.08.02.04 – when used with previous firmware versions the functions are limited and the use with block cyphers is not possible – and NMP version 7.3.x on. For receipt of the SNMP traps any standard compliant SNMP trap receiver can be used. If TLS encryption is used TI-CA from version 1.6.0.2 on has to be used; elder versions generate certificates which are not compatible with the NAMES TLS stack.

3.2.2 Features

3.2.2.1 Multiuser web interface

NAMES is operated via a web interface, which can be used without additional software installation on the user's PC via a web browser. Every user has to login first, before he is given access to the functions he is allowed to use. Up to 30 users (can be configured lower depending on your requirements) can be logged in and use NAMES at the same time.

A complete user administration is integrated, which knows user, user groups and role. Roles are freely configurable volumes of authorisations which can be assigned to a user or groups.

3.2.2.2 Target administration

One of the main concepts of NAMES is the target. A target is a gateways administered by NAMES. Once a gateway is registered manually or automatically through call homes (automatic registration of targets can be disabled due to security reasons), configurations can be deposited for it, logs, traces and call data can be retrieved and jobs can be executed.

Targets can also be grouped in order to simplify the retrieval of call data or the construction of jobs for multiple target groups.

3.2.2.3 Jobs

A NAMES job is an action to be executed on one or more targets. The following jobs are possible with NAMES currently:

- **Firmware update:** A previously in NAMES deposited firmware image is loaded onto a gateway.
- **Configuration upload:** A configuration created with NTConf (from NMP) and deposited in NAMES is loaded onto a gateway.
- **System reset:** A gateway is restarted.
- **Log download:** The log book of a gateway is retrieved and the logs are saved within the NAMES data base. The downloaded logs can later be called for and shown in the TI client (from NMP) by entering the time period in the target administration.
- **Trace download:** Trace files present on a gateway are downloaded and stored in the NAMES data base. The downloaded traces can later be called for and shown in the TI client (from NMP) by selecting a certain trace from the target administration.
- **CDR download:** The Call Detail Records (CDRs) of a gateway are downloaded and stored in the NAMES data base. The downloaded files can later be called for and shown in the call server (from NMP) for a single target or a target group by entering the time period.
- **Time synchronisation:** The clock of a gateway is set to the current time of the hosts' system software.
- **TLS certification:** A gateway configured for TLS but not yet equipped with its certificates is signed and reset by the CA integrated into NAMES.

All jobs can be time and also event controlled (in reaction to a call home event). Apart of the configuration upload all jobs may also be generated for target groups, through which the activity is executed for all gateways within the group.

3.2.2.4 Supervision

If the gateways are configured accordingly, NAMES receives and processes the call homes of the gateways, which are sent when certain events occur. As a reaction to certain events jobs can be executed – e.g. a report about a full log book can trigger a retrieval of the content. NAMES also forwards the reports via SNMP traps to the configured SNMP trap receiver.

If the gateways are configured to send periodical time event call homes NAMES also sends a so called „Link Down-Trap" for gateways, which have loosed out to send a configurable amount of reports. As soon as the gateways report again a corresponding „Link Up-Trap" is sent.

3.2.3 Requirements

For the service of NAMES the following environment is required:

- At least 256 MB free working memory, when more than 20 gateways are administered the working memory should be rescaled accordingly.
- At least two (virtual) cores.
- Microsoft Windows Server 2008 R2 Standard Edition, SP1, German or English
- Oracle Java SE 1.7 Update 51 or higher
- JCE Unlimited Strength Policies for Java 1.7
- If used with an external data base: Oracle DB 11g or MySQL 5.6.x
- Optional: SNMP-Trap-Receiver,
- Internet Explorer 9/10/11
- If used in a virtual machine: VMWare ESXi 5.1

Other compatible software may work but is not supported by NovaTec.

In connection with NAMES the following NovaTec products are suitable for use:

- Firmware Version 00.08.02.04 or higher (previous versions with limitations)
- NMP 7.3.x
- TI-CA 1.6.0.2 or higher

It is recommended to deposit configurations generated with NTConf in NAMES first and load them onto the gateways from there if you use NAMES instead of uploading them directly. Thus NAMES can be used as configuration repository. Please regard, that transferring the configuration with NAMES **no** downloadable copies of the original configuration are deposited on the system, which differs from NTConf.

NAMES uses the system time of the host system for all operations. It is therefore recommended to use NTP or other time synchronization methods in order to avoid unexpected behaviour or disturbances.

3.2.4 Performance

If NAMES is appropriately equipped with working memory, CPU resources and network band it is suitable for the administration of big installations (> 1000 gateways) with a single entity. By consequently using asynchronous technics in multi-threading NAMES can even work at a high level of load and recovers after the peak has passed.

The achieved performance primarily depends on the available working memory and the number of CPU cores, as these make aggressive caching and multi-threading possible. Depending on the load the network connection might also become a bottleneck, if high amounts of data are transferred between NAMES and the gateways (e.g. when the firmware of the entire installation base is updated). High round trip times or packet losses between NAMES and gateway might also lead to loss of performance and should be avoided.

To adjust NAMES to the requirements and circumstances of the customer there are some tuning parameters:

- The working memory in use,
- The maximum amount of simultaneously logged in users,
- The maximum amount of jobs simultaneously executed,
- The frequency of the time events (firmware parameter).

Basically it is to regard, that the use of encryption with TLS always means a loss of performance, as additional calculations and network traffic is generated. The performance of the gateways also plays a role as newer hardware can execute the jobs considerably faster (especially when using TLS).

3.2.5 Design considerations

3.2.5.1 Network connections

To assure a correct function of NAMES it has to be possible to establish all necessary network connections. To enable you to configure firewalls and routes correctly, the following gives a description of the transmission route between:

- NAMES and gateways,
- NAMES and an external data base,
- NAMES and an external SNMP-Trap-Receiver,
- Client-PCs (Browser) and NAMES.

3.2.5.1.1 Connections between NAMES and gateways

NAMES communicates with the gateways as initiator as well as recipient of connections. In the direction NAMES to client the connections for the execution of jobs are established, the counter direction is used for call homes.

The active access to the gateways (NAMES as client) takes place on the ports set in NAMES via TCP with proprietary binary protocol, optionally TLS secured. Default port is 800.

The call home connections (NAMES as server) are established on the port configured in the gateway configuration, likewise with TCP and optional TLS secured.

3.2.5.1.2 Connections between NAMES and an external data base

If an external data base is used NAMES establishes a connection to the data base when started. If the connection is cut off and cannot be re-established rapidly, NAMES shuts itself down after sending a SNMP trap, as it cannot continue its operation and cannot process incoming call homes, which should be triggering a job.

Target port and protocol of the connection comply with the used external data base and have to be entered when first configuring NAMES.

3.2.5.1.3 Connections between NAMES and external SNMP trap receivers

NAMES sends SNMP traps as UDP packages to port number 162 of the configured recipient.

3.2.5.1.4 Connections between client PCs and NAMES

The client PCs access the NAMES web interface with a web browser. This can happen unsecured (via HTTP) or secured (via HTTPS). The port used is configurable but by default the "well known" ports are used: Port 80 for HTTP and port 443 for HTTPS.

3.2.5.2 Redundancy with manual failover

As the entire data is stored within one SQL data base it is possible to hold a second entity available for redundancy in case of blackouts, if an external data base is used. To achieve this you can either simply install a second NAMES entity, which reverts to the same database, or you can also install a second data base server, which is held up-to-date by data replication. If the first NAMES entity or the first data base server has a black out, the second NAMES entity can be started and takes over the processing of jobs and, if configured appropriately, the processing of the call homes of the gateways (see also 3.2.5.3 below).

Data base

NAMES 1   NAMES 2

Picture 29: Redundancy without replication – NAMES 2 is not active

If using the solution with one database server, there is still a single point of failure within the single data base. You can redress this by using data base replication with the tools of the used external data base. When doing so changes to the master data base, used by the active NAMES entity, are periodically duplicated into a data base replica. The second NAMES entity is configured to revert to the replica, but is not active, like in the example without replica.

If the first NAMES entity and the master data base black out (e.g. in case of a power cut or fire in the data centre), the replica can be changed to the new master manually or automatically depending on the data base product. After this has been done the second NAMES entity can be started.

Take care, that NAMES is not configured for the parallel use of multiple entities, as this could lead to plural execution of the same jobs, data corruption or other errors. This is why the second NAMES server has to be set from automatic start to manual start.

Picture 30: Changing the start-type of NAMES to manual

3.2.5.3 Call home events

3.2.5.3.1 Dynamic events

A gateway always contacts NAMES if certain events occur and it is configured, that and where to it should report (call home event). If e.g. an installed gateway has problems with the wiring and the call home events „Layer 1 active" and „Layer 1 inactive" are configured, it will report to NAMES with one of the events when layer 1 shows the corresponding behaviour. This causes a certain load in NAMES, as the call home event has to be accepted, processed and – if applicable – a SNMP trap has to be sent. The real load depends mainly on whether the call home is TLS encrypted – in this case a handshake has to be done – or not, but in any case will remain small.

The load is higher if a call home event occurs, for which a job is configured. E.g. as a reaction to a „Log full" event a job for the download of the log can be configured, which then has to be processed

Call home events, which are not evaluated, should not be configured.

3.2.5.3.2 Time events

Next to the events occurring dynamically there is also the „Time-Event", which occurs in a configurable periodic time interval and is therefore suitable to monitor the gateways. The call home transfers the configured time interval to NAMES, which then knows, at which point of time it can await the next under normal circumstances. If a configurable number of reports fails to come, NAMES sends a „Link down" SNMP trap. If NAMES receives a time event again from that gateway at a later point of time, it sends a "Link up" SNMP trap.

As the time event is sent periodically and constantly by all connected gateways, if configured, it forms a certain basic load for NAMES. As such the frequency of the time events is a main regulating screw for the tuning if many gateways are connected. As NAMES is told the frequency with every time event it is possible to set different frequencies on different gateways in order to put different monitoring levels into effect.

3.2.5.3.3 Transfer without failover

If there is only one NAMES entity in the network, meaning no failover to another entity will be executed in case of a black out, only one call home recipient is configured in the configuration of the gateways. Should NAMES be unavailable, the connection attempt will be retried at intervals of 5 seconds. After a total of 10 attempts the event to be reported is discarded.

3.2.5.3.4 Transfer with failover

If two NAMES entities are used the addresses of both should be deposited in the gateway. If the first configured server is not available for the gateway ten times now, the event is not discarded but ten further attempts to report to the second server are undertaken:

After the server was exchanged, the other server becomes the active server, the order of the notification changes:

The time event is always sent to both addresses. By doing so the gateway can recognise in good time which server is currently active and change the order.

Attention: If two target addresses are used, the time event period has to lie at least 5 minutes, as the gateway will be overloaded elsewise.

3.2.5.4 Rollout with NAMES

When rolling out gateways on site with NAMES there are basically two possible best practises: pre-configuration or semi-automatic provisioning.

3.2.5.4.1 Semi-automatic provisioning

This best practise requires a DHCP server within the network. The DHCP server has to be configured in such way, that it notifies about the address of the NAMES server in option 129. Also the systems to be rolled out

have to be pre-recorded in NAMES and the fitting configuration has to be deposited, additionally an upload of the configuration triggered by the call home "DHCP-Application NMS/NAMES" has to be prepared.

The gateways are preconfigured in such way, that DHCP and the call home event „DHCP-Application NMS/NAMES" are active. After booting the system will request the network configuration from DHCP and afterwards send a call home to the address deposited in option 129. Different from the description under 3.2.5.3.3 above this event is not discarded after ten failed attempts but repeated until the system receives its configuration.

If a configuration and upload task is deposited in NAMES for this system (identified by backplane ID) a configuration upload job is automatically generated and queued for processing. The job is then processed within the normal scheduling and the configuration is transferred to the system. The system is now provisioned.

3.2.5.4.2 Pre-configuration

Should the practise of semi-automatic provisioning be unwanted or impossible, e.g. because there is no DHCP server available or the option cannot be configured, the possibility of manual pre-configuration is convenient. In this case the system has to be pre-configured with NMP by a technician before being rolled out. In case of a failed DHCP retrieval the systems adopt a standard IP, under which they are available within a corresponding lab network.

3.2.5.5 Licensing

Every separate NAMES entity requires its own license. So in case you have a redundant structure as described in 3.2.5.2 above, you need to purchase two licenses.

The licensing takes place as soft dongle, which is fully compatible with the operation in virtual machines. After the installation of NAMES, during which a soft dongle with a time limited test license is automatically installed, a file has to be sent to NovaTec with help of an included tool, which is then used by NovaTec to generate a time unlimited license.

NAMES is licensed according to the planned number of gateways. The license then contains a maximum amount of with NAMES administrable gateways. As such NAMES can be used for big installations as well as for small installations.

3.3 NovaTec Performance Management

3.3.1 Overview

The NovaTec Performance Management Tool is a tool for the analysis of the performance of the IP network and its components with help of the statistical data flow values of the NovaTec gateways. For this defined information elements within the CDR (Call Data Records) of the NovaTec gateways are used.

E. g. the ASR value of the CDRs of the NovaTec gateways gives information about the relation between attempted and successful connections within the network. This information can be put into graphs or tables with help of a few configurable and preset parameters in the Performance Management Tool of NovaTec.

3.3.2 Requirements

The software required for operation of the *Performance Management* contains the following components:

- Windows 7, Service Pack 1
- Windows Server 2008, Service Pack 2

Further details to this program can be found in the handbook of the product, which can be found at
https://www.novatec.de/handbooks/Performance%20Management%20V1%2020_26042012_engl.pdf

3.4 NovaTec Remote Adjusting of Call Forwarding

This tool is an extension of the NovaTec Trace Info Client tools from the NMP package.

A CLI (Command Line Interface) interface has been implemented into this extension in order to enable remote control or programming of call forwarding within the NovaTec gateways.

This function is supported from firmware version 00.07.04.00 on.

For detailed information see: https://www.novatec.de/handbooks/IP-KonfigurationmitCLI%201.3_engl.pdf

4 Influence of configurational steps on system performance of AMGWs

In this chapter the basic configuration steps of the NovaTec systems in gateway operation are described depending on their setup (see chapter 2) and network specific parameters.

The settings in the configuration which can have influence on the systems performance are:

- Length of call number plans. The longer and more nested a call number plan is, the longer the search for the route takes within the system.
- External „Music on Hold" influences the transfer of the configuration by enlarging the configurational data strongly.
- ALCR: When activating the Advanced Least Cost Router various routes are evaluated and this also leads to CPU load.
- Depending on the type of hardware (S5+ up to S21 or higher) the number of used interfaces and modules also have influence on the performance of the complete system.
- RSA key: The length of the RSA key has a direct impact on the performance of the system when first setting it up and also during operation. With a key length of 2048 bits a restart (if the key has never before been generated) can take from 1 and up to 8 minutes. The influence in operation and the chronology connected with this can be found in chapter 5.
- When using TLS 2048 bit the TLS set-up time is extended to 10 seconds.
- A call on the SIP side is delayed in accordance with the inter digit timer, the value in seconds is configurable.
- A delay only occurs if the called number is shorter than the configured minimum length and no # is entered as end of the number.
- MoH: File size 300 KB, boot time approx. 0:44 Min, file size 625 KB, boot time approx. 1:04 Min (File size describes the actual size of the file on the target system. The size of the file may decrease considerably in comparison to the original wav file by the conversion in the user interface).

5 Influence of the configurational steps on to the system performance in server or proxy mode

In this chapter the main configurational steps of the NovaTec systems in server or PROXY mode depending on their setup (see chapter 2) and network specific parameters are described.

The settings of the NAME server, the configuration of the system and the job application, which can have influence on the system performance of the server, are:

- Hardware/Server used for NAMES
- Operation with or without encryption
- Network performance (a good round trip time is important, as NAMES has to confirm the receipt of data from the AMGW. If the confirmation is delayed the entire process takes longer and the server is occupied for a longer period).
- RSA key 1024/2048
- Configurational size of the system (AMGW)
- FW size for the system (AMGW)
- Call home events in the configuration of the systems (AMGW)
- Amount of AMGW in the job data base
- Scope of tasks for a call home event in the job management
- FW update
- Configuration update
- Read-out of trace
- Read-out of logbook
- Read-out CDR
- With TLS 2048 bit the TLS build up time is stretched to 10 seconds.
- A call to the SIP side is delayed in accordance with the inter digit timer, the value is configurable in seconds.
- A delay only occurs if the called number is shorter than the configured minimum length and no # is entered as end of the number.
- MoH: File size 300 KB, boot time approx. 0:44 Min, file size 625 KB, boot time approx. 1:04 Min (File size describes the actual size of the file on the target system. The size of the file may decrease considerably in comparison to the original wav file by the conversion in the user interface).

6　DHCP

All NovaTec systems are ex-factory adjusted for DHCP mode. This setting is optimized for the automatic setup in connection with the NovaTec Network Management System (NMS) in a customer network. As in some networks DHCP servers are not available and the automatic setup of the NovaTec systems within the customer network requires certain settings in the DHCP server, we will give further information on this topic in this chapter.

In order to optimize the attunement of the IP ports in the network and the settings in the firewalls, DHCP and DNS servers with the NovaTec applications and systems you can use the port matrix under
https://www.novatec.de/handbooks/IP-Portmatrix_engl_27032019.pdf

6.1 Activating DHCP

When selecting menu node „System-IP-Options" in the left sub window of the application "NTConf" the following dialog will open in the right sub window:

DHCP options can now be defined by selecting the corresponding elements in the two combo boxes.

If DHCP is activated, not required input boxes are shown greyed out and thus are deactivated. The system requires a clear name „Local Name".

6.2 Exemplary configuration of a DHCP-Server

In the following it is exemplary described, how the DHCP server of the Internet Services Consortium (ISC DHCP; https://www.isc.org/software/dhcp) can be configured for the use with NovaTec AMGWs.

Next to the usual information about IP and routing the AMGWs require the IP addresses of the configuration servers. The corresponding DHCP options have to be defined first, as they do not count to the standard options of the ISC DHCP. To define these, the following entry has to be added in the top level of the configuration file (usually /etc/dhcpd.conf):

The following values can be provided automatically via the DHCP server to the NovaTec gateway SX:

- Local IP address
- Subnet mask
- Gateway
- NAMES server (DHCP option 129)

Via DHCP option 129 the IP address of the NovaTec MS system is conveyed to the NovaTec gateway and hereby an automatic download of a previously deposited configuration can be triggered (for the particular gateway). This configuration has to be deposited in the „Call Home Job Management" and „Update Configuration" has to be activated.

Option nms -server code 129 = ip-address;

This enables the use of the "nms-server" option.

In order to send the options to the NovaTec AMGWs, the following configuration directives may be used:

class "novatec_sub_class" { match option vendor-class-identifier;
}

 subclass "novatec_sub_class " "NovaTec System: S3" { option nms-server xxx.xxx.xxx.xxx;
}

 subclass "novatec_sub_class " "NovaTec System: CCU3" { option nms-server xxx.xxx.xxx.xxx;
}

Instead of "xxx.xxx.xxx.xxx" enter the IP address of the server, which is providing the corresponding service. Depending on the used NovaTec AMGWs the required options and vendor class identifier differ. The correct identifier can be found in the table below.

A further differentiation by subnet, host name, hardware address and so on is possible; please check the documentation of the ISC DHCP for this purpose.

NovaTec system	Vendor class identifier	Remark
S3	"NovaTec System: S3"	NAMES/TFTP server IP only for S3 systems
CCU3 for S5+, S6, S6+, S7, S20, S20+, S21	"NovaTec System: CCU3"	NAMES/TFTP server IP for S3+, S6 and S20 systems
BCUx for S5+, S6, S6+, S7, S20, S20+, S21	"NovaTec System: BCU"	NAMES/TFTP server IP for BCU is not required

DHCP class identifier

Access to the configuration server is only possible if the own IP address, the net mask and the gateway IP (if not in subnet) are provided by the DHCP server apart of the server IP address.

6.2.1 Admin PC / First configuration

The configuration is installed via administration PC with the "NovaTec Configuration" tool (NovaTec Maintenance Package).

The initial configuration file can be found in binary form (XXX.mbd) in the data path „C:\NovaTec\NovaTec Maintenance Package (NMP xxx)\config".

The default IP for the NovaTec device is 192.168.127.254, Username is „Technik"

7 VoIP Security (TI-CA as signing body)

NovaTec systems can be configured, certified and signed in two ways within a TLS secured network. In this chapter the configurational structure and procedure when using the NovaTec certificate authority server (TI-CA) are described, the approved operating systems and the entire structure within an accepted PKI are shown.

The following procedure is recommended for all customers for the secure handling of encryption (TLS/sRTP) between NovaTec systems and the service PC.

7.1 Creating a "Root Certification Authority Certificate"

Secure Microsoft Server

Safe

- Root CA key
- Root certificate
- Root password

TI-CA

Step 1: TI-CA creates
- Root CA key
- Root certificate
- Public certificate

The first step in preparation is the once-only creation of a „Root Certification Authority Certificate" (Root-CA). In case a certificate of a certification authority already exists, this step can be skipped.

The creation of a root CA has to be done with the NovaTec tool "Trace info Certificate Authority" (TI-CA). The application should be installed on an access secured Microsoft server. Access secured meaning that the server should be in a locked room without LAN connection.

Via the „Graphical User Interface" of the TI-CA application an encrypted root CA key (cakey.pem), a root certificate (cacert.pem) and a public certificate (cacert.crt) are now created.

The root CA key (cakey.pem) and the password for this key are the most sensitive parts of a CA infrastructure and have to be stored in a safe place, e.g. a safe, together with the root certificate (cacert.pem).

For the transport to and from the safe you can declare e.g. an USB stick as data carrier for the output file to the TI and store this in the safe.

The so secured "Root-CA" serves only for the signing of other certificates (see following chapters).

The public certificate (cacert.crt) is provided to all systems within the CA infrastructure.

7.2 Obtaining a TLS license

In step 2 the customer has to read out the MAC address of the corresponding system (S3 to S21) with help of the TI application and send it to the NovaTec support via email.

Picture 31: Copy – MAC to Clipboard

NovaTec then determines an individual activation code for this system and returns a TLS license „tls.lic" to the customer by email. In case the customer wishes to activate more than one system in one go, a TLS license can be created which is valid for all systems, with whose MAC addresses the license was created.

7.3 Configuring encryption

Service PC

Public certificate

Email from NovaTec
with activation code

CONF

LAN, V24 or ISDN
configuration of TLS, reboot

7.4 Configuring TLS for NovaTec systems

Only a system whose MAC address is included into the TLS license can be activated and configured for TLS in this step via the NovaTec configuration program „NtConf".

For this purpose there are three categories in the configuration interface: NMS, SIP and maintenance. Whereat maintenance includes the applications „TI", „NtConf" and „Callserver".

After loading the TLS license (step 2) the three given categories for TLS/sRTP can be turned on and configured. Depending on the degree of safety the modes as given under 7.8 are possible, e.g. importing the "Public Certificate" (cacert.crt).

The unsecured access to the systems on site is no longer possible after TLS has been activated. All access attempts via V24/USB, ISDN and IP as well as HTTP and TELNET are not accepted if TLS is activated.

7.5 Creating private key in the system

Creation of
- encrypted private key
- request for MNT, NMS and SIP

NovaTec

7.5.1 NovaTec system creates private key and requests

This step only works, if the configuration in the previous step has been done completely and without mistakes. This step happens automatically when rebooting and takes 20 to 30 seconds with a key length of 1024 and up to 8 minutes with a RSA key length of 2048 plus the normal reboot time.

As soon as the configuration file is transferred onto the hardware it begins to check the activation code for validity after the necessary reboot. If the verification is positive the NovaTec hardware accepts the new configuration with encryption.

Additionally the reboot after successful configuration triggers the following system internal actions:

CREATE HARDWARE PRIVATE KEY

Creation of an encrypted private RSA key, which is held in the non-volatile memory of the hardware. Access to this memory from the outside is impossible.

The key remains in the hardware and can neither be read or overwritten nor deleted. The key password is not stored but generated individually and dynamically in accordance to the hardware's runtime. As such there is a different password for every system.

The algorithm for the dynamic generation of the password is not accessible even company-internal (only library) and it lies separately and secured.

CREATING HARDWARE CERTIFICATE SIGNING REQUEST

After creation of the private key each of the three configured categories SIP, Maintenance and NMS generates a corresponding "Certificate Signing Request".

Maintenance, NMS and SIP create the files „mtn_req.csr, nms_req.csr" and „sip_req.csr" with help of the private key and save these in the Flash file system. Certificates and other files necessary for TLS can only be viewed on the system with the TI-CA application.

Attention: The request files are automatically deleted after being opened successfully for the first time.

7.6 Signing of the „Hardware Certificate Signing Request"

Picture 32: NovaTec system is signed locally by server

Picture 33: NovaTec system is signed by service PC

The previously described three „Certification Signing Requests" created by the hardware have to be signed by the „Root-CA" (or rather a higher-level CA) .

With this action you receive the required certificates (files) for the hardware: „mtn_cert.crt", „nms_cert.crt" and „sip_cert.crt".

The execution of this step is critical as it requires the encrypted Root-CA key (cakey.pem) and the corresponding password.

The transport between safe and secure server can be executed with an USB stick for instance. TI-CA can import the file (cakey.pem) directly from the USB stick.

The three request files are then retrieved from the flash file system by TI-CA and signed before the created certificates are copied into the flash file system of the hardware. The transport of these files can be executed unsecured, as the protection is not activated until after the next reboot.

Attention: If the certificate is invalid the system is blocked and has to be set back to default on site.

This step ends with a reboot after which the NovaTec system is ready for use.

7.7 Creation of a PC key and certificate

Picture 34: TI-CA signs the NovaTec PC tools MNT and NMS

In order to enable the PC to communicate with the NovaTec hardware the PC applications have to be incorporated into the CA infrastructure. Hereunto TI-CA creates an encrypted private key and a certificate signed by the CA. These files have to be saved on the service pc together with the public certificate of the CA and imported into TI, CI, CONF and NMS/NAMES. The password of the private key has to be imported as well of course (e.g. with an encrypted USB stick).

After this step all actions are completed and the service PC can communicate with the NovaTec system in TLS secured mode. This step is not necessary with SIP connections between the NovaTec systems.

7.8 Explanation of hardware TLS 1.0 modes in accordance with RFC4346

Server modes for the applications Maintenance (TI, NtConf, Call server) and SIP

Mode	Server Key	Server-Cert	CA-Cert	Notes
0	-	-	-	Unsecured
1	mandatory	-	-	Anonymous mode, is not supported
2	mandatory	mandatory	-	Optional: No client validation Security: middle
3	mandatory	mandatory	mandatory	Full validation: high security **Flag: Server-Authentication**
4 - 8	-	-	-	Not allowed with TLS

TLS Security – Server Modes

Client modes for the applications NMS and SIP

Mode	Client-Key	Client-Cert	CA-Cert	Notes
1	mandatory	-	-	Anonymous mode, is not supported
2	mandatory	-	mandatory	Optional: No client validation Security: middle
3	mandatory	mandatory	mandatory	Full validation: High security **Flag: Client-Authentication**
4 - 8	-	-	-	Not allowed with TLS

TLS Security – Client Modes

Secure Microsoft Server

Safe

- Root certificate
- Root private key
- Root password

TI-CA

Step 1: TI-CA creates
- Root CA key
- Root certificate
- Public certificate

Step 5: TI-CA crates and sends certificate for MNT, NMS and SIP

Step 5: TI-CA retrieves request for MNT, NMS and SIP

Step 6: TI-CA creates certificate and encrypted private key for MNT or NMS
Attention: This has to be transferred manually, e.g. with an encrypted USB stick.

Step 6:
SIP with TLS/SRTP

Service PC or NMS Server

TI,CI CONF

Public certificate

Step 7: TLS connection

NovaTec

Step 4: Creation of
- Encrypted private key
- Request: MNT, NMS and SIP

Steps 2 and 3: unsecured connection for TLS configuration

Email from NovaTec with activation code

Picture 35: CA infrastructure

Remark to step 5:

The communication between TI-CA and the NovaTec system is executed manually at the time being with an internal MMX protocol. If the customer has an own CA server, the protocol SCEP (Simple Certificate Enrollment Protocol) can provide for an automatic secured data exchange in step 2 (SCEP is not part of delivery for the

time being). More information about configurational steps and more detailed instruction about the use of No-vaTec gateways in a PKI infrastructure can be found in the following document:

https://www.novatec.de/handbooks/Handbuch_TLS_sRTP_engl_ext.pdf

8 VoIP Security with SCEP (Foreign server as signing entity)

From a certain release on NovaTec systems support the „**Simple Certificate Enrollment Protocol"** and can be signed with a foreign server (e.g. Microsoft 2008 CA-Server). For a complete automation of procedures within a certain PKI customer or network related adjustments might become necessary on the NovaTec systems.

The feature SCEP in NovaTec gateways is carried out in accordance with the definition in „draft-nourse-SCEP-20" for the automatic signing of certificates through a foreign CA server.

Scale, run time, parameter, design etc. depend on the corresponding network and its size, the PKI and the used SCEP server and require a rating or design within a low level design.

The currently possible adjustments in the NovaTec gateways are shown below with help of a hardcopy of the configurational interface:

Operating parameters - SCEP Settings

Enable SCEP

Use SCEP : ☑

Parameters for SCEP

SCEP Server's URL:	http://testserver.novanet.local//cgi-bin//pub//pkiclient.exe:80 max. 255 characters
SCEP host port:	80
PKCS#7 encryption algorithm:	DES
PKCS#7 signature algorithm:	SHA1
Max. number of Request:	256
Polling interval in seconds:	30000
Max. polling time in seconds:	2880000

Picture 36: SCEP Settings

9 TLS

In this chapter the behaviour of the NovaTec systems in order to achieve maximum security against external influences and manipulation is described. Also the handling on site of gateways in secure mode and switching between different RSA keys and their impact on the behaviour of the systems are discussed.

After TLS has been activated in the NovaTec gateway due to safety reasons all maintenance accesses, which might allow access without TLS, are blocked. These are:

- V.24 interface
- USB interface
- ISDN interface

This state can only be undone by returning the system into default state (no other function is possible within the secure network any longer).

When activating TLS (also see chapter 7) encryption can be executed with the different key lengths (depending on requirement) 1024 bit or 2048 bit.

NovaTec systems are delivered with a pre-set 2048 bit key.

9.1 RSA key settings

9.1.1 Procedure when changing RSA key from 1024 to 2048

1. Set value 2048 under operating parameters in the data base.

2. Via the button „Licensing → Reload FW-license" a FW license is loaded, which does not belong to the MAC address of the system.

3. Preparing and transferring of the data base onto the system.

4. After the data base has been transferred, the LEDs of the CCU or S3 flash. This procedure may take several minutes.

Generating
of the
RSA Key

Running
mode

○   LED is off

⊗ ⊗   LED blinks

● ●   LED steady on

CCU-3

Running mode

○   LED is off

⊗   LED blinks

●   LED steady on

S3

5. After the system has performed a reset it can be controlled via the TI client if the RSA key has been created. If the RSA key version shows „00.00.00.02", key 2 has been generated.

9.1.2 Procedure when changing RSA key from 2048 to 1024

1. Set value 1024 under operating parameters in the data base.

2. Via the button „Licensing → Reload FW-license" a FW license is loaded, which does not belong to the MAC address of the system.

3. Preparing and transferring of the data base onto the system.

4. After the data base has been transferred, the LEDs of the CCU or S3 flash. This procedure may take several minutes.

Generating of the RSA Key

Running mode

○   LED is off

⊗ ⊗   LED blinks

● ●   LED steady on

CCU-3

Running mode

Power	Ready	ATA	ISDN	VoIP	LAN

○   LED is off

⊗   LED blinks

●   LED steady on

S3

5. After the system has performed a reset it can be controlled via the TI client if the RSA key has been created. If the RSA key version shows „00.00.00.01", key 1 has been generated.

10 NovaTec Sync. Admin

10.1 Overview

From a certain release on NovaTec systems support clock pulse synchronisation via received RTP packages. To achieve a central clock pulse synchronisation of all network components "RTP master Clock Server: RMCS" was developed within the Sync. Admin concept of NovaTec Kommunikationstechnik GmbH. The RMCS is also capable of selecting one out of multiple available reference pulses (e.g. ISDN) and to synchronise itself and all connected gateways in the network. Hereby network internal as well as external connections are synchronized among one another. The operation is RMCS mode is possible from NMP version 6.7.0.4 and firmware version 00.07.03.01. The hardware requirements can be found in chapter 10.3.5.

In this chapter the various synchronisation possibilities in dependency to the network structure and the given requirements to the network quality for achievement of a certain clock pulse accuracy are described. Furthermore hardware setup, limits and redundancy are described.

When constructing a RMCS server multiple servers can be setup as redundant. The NovaTec gateways are per configuration capable to select one of multiple servers and to use its RTP stream for synchronization.

A RMCS server can be assembled from the following hardware components:

- Depending on the number of gateways within the network and the synchronization needs one or multiple Sx chassis.
- One or two redundancy capable power supplies (only with S6+, S7, S8, S20/S20+ and S21 Chassis).
- One CCU3 or multiple CCU4/ CCU6 with a S04 daughter board (Master/Slave).
- BCU32 (1x with S5+, 4x with S6/S6+/S7, up to 11x with S21 and 15x with S20 and up to 12x with S20+). When using CCU4/ CCU6 the use of BCU is not necessary.
- One S04 cable when using CCU3 and one or multiple RJ45 patch cable when using CCU4/CCU6.
- One patch panel.
- One installation set.

Chassis with CCU3	S5+	S6/S6+/S7	S20/ S21	S20+
Amount of BCU32 / BCU16*	1	4	6	12
Maximum amount of synchronisation channels with RTP	32	128	192	384
Maximum amount of synchronisation channels with sRTP	15	60	90	180
Chassis with CCU4/ CCU6#	**S5+**	**S6/S6+/S7**	**S20/ S21**	**S20+**
Amount of CCU4/ CCU6#	1	5	17/ 12	15
Maximum amount of synchronisation channels with RTP and sRTP	128	640	2176/ 1536	1920

*: If sRTP is activated only BCU16 should be used to optimize the degree of utilisation!

#: Use in S5+ only possible from R-State -R3 (E.g.: 1F5201-xxx-xxxx-R3).

The RMCS servers do not need to be used with sRTP as no real call is transferred in the RMCS stream between RMCS client and RMCS server but only the music on hold melody is played. Should TLS be used due to security reasons (Defence against external attacks to prohibit synchronisation), sRTP can be used. When doing so, only 15 clients per BCU can be served at the same time.

In order to ensure the „Call Admission Control Mechanism" when using a superior switch, e.g. Cisco Unified Communication Manager (CUCM), the connection control (SIP signalling) between RMCS server and the AMGW can also be executed via the CUCM. When doing so, all SIP signals can also be transferred secured with TLS.

One S0 (BRI) or S2M (PRI) interface is necessary per RMCS server for the synchronisation with the ISDN outside line. You need to take care that layer 1 of the outside line is set as permanently active. Outside lines can also be used as bus connection. These lines enable a multiple connection of outside lines to minimum two RMCS servers. As such an additional security is built into the redundancy concept (see picture below), in which the RMCS can use the reference pulse from the second outside line of the second RMCS server in case the first outside line drops out. So if only one S0 (BRI) outside line drops out both RMCS servers stay active. Only if both outside lines drop out at the same time the servers will go into standby mode and refuse all requests of the AMGWs until the reference lines are re-established. The following drawing illustrates the networking of two RMCS servers:

Picture 37: Cross-over connection of two RMCS servers

In order to receive a redundant structure the RMCS servers are installed on two different sites as shown above.

10.2 Example for a possible network structure

On every site nine pairs of RMCS servers are installed. One site houses the primary RMCS servers the other site the secondary (fail over) RMCS servers. On every site 18 ISDN outside lines are required. I.e. 18 pairs consisting of a primary and a secondary RMCS server exist, but are not physically connected to one another. As such 18 RMCS servers are permanently available with a capacity of 128 clients each. In case the primary server is not available, dropped out or busy the RMCS client will try to reach the secondary RMCS server (corresponding adjustment of the AMGWs configuration). If the secondary is not available either the data call is rejected by the

AMGW (unless it has another clock pulse source). So the available AMGWs have to be spread onto 18 pairs of RMCS servers. The following drawing illustrates the RMCS network structure:

10.3 Description of a RMCS server

In the following paragraphs the RMCS set-up is shown and described by means of a NovaTec S6 in full assembly with redundancy capable power supplies and secured network cable:

Picture 38: NovaTec S6 as RMCS server

10.3.1 Interfaces RMCS S6/S7

10.3.1.1 TDM side

The RMCS server can be modularly equipped with S0 (BRI) or S2M (PRI) interfaces for the synchronisation with the ISDN outside line.

10.3.1.2 IP side

The RMCS S6 has five Ethernet interfaces when fully assembled. The Ethernet interface of the CCU is only used for signalling (SIP and TLS) and maintenance. The other four Ethernet interfaces on the BCUs are used for the RTP streams used for synchronisation of the clients.

In the RTP data streams the configured MOH sound is played by the corresponding RMCS.

The NovaTec RMCS system is connected to an access switch with all four BCU fast Ethernet ports and configured with a fixed IP address.

For a better prioritisation of the RTP streams the VLAN for these ports has to be switched on / configured.

The port of the CCU module is in charge of the configuration and signalling of the system and is assigned to the management.

10.3.2 Bandwidth at maximum wiring S6/ S7

RTP G.711 maximum 128 parallel links possible

128 x 90kbit/s = 11.520 kbit/s

Signalling (SIP TLS): 128 connections x 0,619 kbit/s = 79,23 kbit/s

- Expedited Forwarding
- Traffic class: Priority
- Assured Transport-1

10.3.3 Operation of the SUP board (S$_0$ BRI board) in RMCS servers

The SUP daughter board has four independent S0 BRI interfaces (Basic Rate Interface) on board. These interfaces can be operated in master or slave mode or point-to-multipoint or point-to-point mode per configuration. One board per CCU is used in every RMCS server. All interfaces are used in point-to- multipoint or point-to-point mode in the following set-up example for the use in a RMCS server. The S0 BRI interfaces can be used with or without terminating resistor (necessary depending on the topology of the point-to-multipoint connection). The corresponding terminating resistors can be switched on and with sliding switches on board (see table below).

The SUP daughter board is available in various versions and with or without phantom powering depending on the application. For the use in a RMCS server powering is not necessary.

The following table shows how the terminating resistors can be switched on or off. If the sliding switches are moved into the other position, the terminating resistors are switched off.

SLIDING SWITCH LEFT TERMINATING RESISTORS		
Switch and state		Effect
1-2	On	Line-1: 100R on
3-4	On	Line-2: 100R on
SLIDING SWITCH RIGHT TERMINATING RESISTORS		
Switch and state		Effect
1-2	On	Line-3: 100R on
3-4	On	Line-4: 100R on

The following picture shows the position of the sliding switches on the SUP board.

10.3.4 Connecting the RMCS server to a S$_0$ BRI interface

According to 10.2 „Example for a possible network structure "

The following picture shows the connection of 18 RMCS servers to one S0 interface:

In the ISDN connectors and in the RMCS servers 1 to 17 no terminating resistors must be included or have to be switched off. In the NTBA and on the S0 BRI board of the 18th RMCS server a terminating resistor of 100 ohm has to be switched on.

Attention: The connection (Transmit and Receive) between NTBA and NovaTec interfaces has to be twisted.

Patch Panel for RMCS Server

RJ-45 Pinning

Pin	Funktion am S0-Bus
1	leer
2	leer
3	2a (RX+)
4	1a (TX+)
5	1b (TX-)
6	2b (RX-)
7	leer
8	leer

10.3.5   Characteristics of the gateways in use with RMCS operation

Not every S3 version can interpret the pulse from the RMCS server (only S3 versions with identifier „R" at the end of the order number, e.g. 1F8000R, can interpret the RTP data of the RMCS server). Should it be tried to use a S3 on a data call with RMCS synchronisation, which is not RMCS capable (i.e., the S3 is configured as RMCS client), the data call is rejected and the error report 4623, „L3-RTP-SYNC: HW can not synchronize on RTP stream!" appears in the trace. Only if the RMCS service is deactivated in the configuration of the S3, which is not RMCS capable, data connections are possible again on such a S3. The trace mask has to be set to 74000

fpr module L3_ISDN and TraceLevel4 and the option "RMCS/RTP synchronisation" has to be active so that the error report appears in the trace. The error report also appears in the log book and is createt anew with every data call.

Due to the limited capacity of the S3 the following has to be heeded:

When using RMCS only one data call with link aggregation is possible at the same time. During this call three VoIP channels are occupied – two for the data call with link aggregation and one for the call to the RMCS server. As the S3 only has four VoIP channels two data calls with link aggregation at the same time are not possible, as this would require five VoIP port when using RMCS.

In order to enable link aggregation at all in a network with CUCM, the busy trigger for S3 in the CUCM must be set to „4".

For RMCS use with S5+, S6- S7-, S8-, S20- and S21 gateway versions the construction level of the used CCU3 must be higher than R8B and the ULUs higher than R2B (see serial number label on the corresponding board as shown below). When assembling with CCU4 or CCU6 all versions can be used. With S3 versions only versions with identifier „R" at the end of the order number can be used (see label on back of system and also chapter 2.70).

Label CCU3

Label ULU

⚠️ The synchronisation of NovaTec gateways in connection with RMCS is always dynamic and only for the duration of the data connection. In the phases without connection on the IP side or during voice connections no synchronisation takes place. In these phases the NovaTec gateways are synchronised with their internal quartz and can pass this pulse to the systems arranged behind. Some applications or interfaces of some ISDN telecommunications systems or ISDN systems require a permanent pulse on the interface to the gateway with a minimum of accuracy. In these cases the BCU modules equipped with 1 Hz precision clock pulse source should always be used with S5+ to S21.

11 Factory settings and rollout

11.1 Overview

NovaTec systems have a series of factory settings depending on the soft- and firmware versions existing at the time of their production.

In this chapter the basic settings and in the corresponding release notes the individual settings depending on the firmware are described. Should the release notes not include a description of these, the settings equal those of the previous version.

The following settings are existent in NovaTec products by factory:

USERNAME

The username is „Technik" and cannot be changed. If you enter a username unknown to the system before transferring the configuration, the transfer will fail.

PASSWORD

The system has no password when delivered. It has to be set via the Trace Info Client (entry in box „Password": old;new;new). If you enter a password unknown to the system before transferring the configuration, the transfer will fail.

DHCP active. If the DHCP server is not found after rebooting, the system will switch to the following default IP settings:

For S3:

DHCP	DHCP on (Default-IP)
Default IP:	
Local IP address:	192.168.127.254
Subnet mask:	255.255.0.0
Default gateway:	192.168.1.254
S0 (BRI) interface 1:	Point to multipoint, MSN 301
S0 (BRI) interface 2:	Point to multipoint, MSN 302
IP interfaces:	SIP Trunk
Codec properties:	X-CCD pcma (G711a) pcmu (G711u)
User mapping:	192.168.127.25
RMCS RTP stream:	activated

For S5+ to S21 with CCU3:

DHCP   DHCP on (Default-IP)

Default IP:
Local IP address: 192.168.127.254
Subnet mask: 255.255.0.0
Default gateway: 192.168.1.254

CCU3 slot 1:   S04 board
CCU3 slot 2:   S2M board

Slot 2:   empty
Slot 3:   CAU (3x So4)
Slot 4:   CAU (3x So4)
Slot 5:   CAU (3x So4)
Slot 6:   CAU (3x So4)
Slot 7-17:   SCU

S0 CCU3 interface 1:   Point to multipoint, MSN 20, 21

Additional S0:   Point to point (Master/Slave)

S2M (PRI) CCU3 interface 5:   Outside line (Slave)

S2M (PRI) CCU3 interface 6:   Outside line (Slave)

Generally the information in chapter 3.2 can be useful for rollout. For complicated networks all conditions and special requirements of the network have to be regarded and described in a specially fitted low level design. This document can be helpful and used as input for the creation of LLDs.

11.2 Firmware license

The firmware license is linked to the MAC address of the corresponding system. It is also possible to create group licenses. The MAC address can be read out with help of the NovaTec TI-C toll from the NMP package and is also given on the system label (on the back of S3 – see chapter 2.5 – or on the back plane connector of the CCU –see chapter 2.6).

Generally no new license is needed if you update to a firmware bug fix version. Bug fix versions only differ from the original firmware version by the last two digits.

Example:

Update from 00.06.07.00 to 00.06.07.02:
Update to a bug fix version. A new license is not needed.

Upgrade from 00.06.07.00 to 00.07.00.55:
Upgrade to a firmware version with new features. A new license is required.

In case a downgrade or upgrade is required or demanded please contact our sales department. The available and approved firmware versions and the related release notes can be found at
https://www.novatec.de/download/#1545139611714-acd31bc6-769d

11.2.1 Firmware preconditions

From firmware version 00.06.07.00 on every firmware requires a license in order to ensure the functionality of the corresponding Sx systems. If the license is missing, telephony with the system is not possible and it can only be accessed remotely.

Depending on whether or not you have a customer's account on NovaTec's website, it is possible to generate licenses yourself on our website or to achieve it from the NovaTec sales department by email. For details please contact the NovaTec sales department.

11.2.2 Firmware Upgrades

Please consider the following when updating a system:

a) Systems with a firmware version older/smaller than 00.06.07.00:
An update to FW 00.06.07.00 or higher always requires a license file. The license cannot be read out of the system or saved.

b) Systems configured with NMP 6.3.2 or 6.4:
To transfer the configuration onto the system a license is required regardless of the firmware version. The license file has to be loaded into the date base with the NovaTec configuration interface once before the configuration can be transferred. The license cannot be read out of the system or saved.

c) Systems configured with firmware version 00.07.00.55 or higher or with NMP 6.5:
A valid license file is already resident in the system and NMP 6.5 allows the transfer of the configurational data without previously loading a license. The license file remains within the system. It is only deleted if overwritten with another license file or if the flash is deleted (Login with „nopasswd"). A new license file is only required if an update to a newer firmware version is to be executed.

⚠️ Parallel to the dispatch of the Sx system you receive the license file by email. Or you can create it yourself on the NovaTec website, if you have a standing order (for more details please contact the NovaTec sales department). Store the license file well. Supplementary deliveries are with costs!

Note A full compilation of all firmware versions and corresponding features as well as hard- and software dependencies and compatibilities can be found on our website at
https://www.novatec.de/download/#1517645738542-5af137b7-0708

11.2.3 Loading the license into the configuration

The license is loaded into the configuration as follows:

Picture 39: Menu „Licensing"

The menu item "Show licensed MACs" shows a list of MAC addresses. The firmware license is valid for all NovaTec systems listed here.

Picture 40: MAC license info

How to obtain and load a TLS license is described under 2.1 in the document https://www.novatec.de/handbooks/Handbuch_TLS_sRTP_engl_ext.pdf . After loading a new TLS license existing TLS certificates in the configuration remain. But existing IP services like UDP or TCP for SIP are deactivated.

From NMP version 6.6.0.0 firmware and TLS license can be verified with the application „Trace Info Client". For this a connection to the AMGW has to be established and the state in tab "System Security" has to be checked. On the next page is an exemplary picture.

Picture 41: Review of license (Exemplary picture)

Remark to exemplary picture:

The firmware license is valid but the TLS license has not yet been loaded. To operate an AMGW with TLS both licenses have to valid, both lamps have to be green.

Should the system not be available after being configured please press the reset button twice. Hereby the Sx is reset to default settings; The IP settings are now like the factory settings.

⚠️ When operating a system with an invalid license no calls or data connections are possible. Maintenance connections though are always possible. If the TLS license is missing no TLS connections are possible. In this case only connections not secured with TLS like TELNET can be established.

12 Abbreviation index

- ALCR: Advanced Least Cost Router
- AMGW: Access Media Gateway
- ANA4: Analogue connection board with 4 interfaces
- ASR: Answer Seizure Ratio
- BCU: B-Channel Unit
- BRI: Basic Rate Interface
- CAU: CArrier Unit
- CDR: Call Data Records
- CCU3: Central Control Unit Modell 3
- CCU4: Central Control Unit Modell 4
- CCU6: Central Control Unit Modell 6
- CLI: Command Line Interface
- CODEC: Coding and Decoding
- DC4: Direct Current model 4 for So
- DHCP: Dynamic Host Configuration Protocol
- GSM: Global System for Mobile Communications
- IP: Internet Protocol
- ISDN: Integrated Services Digital Network
- kW/s: Kilowatt per second
- MCU: Mobile Central Unit
- MNT: Maintenance Task in the NovaTec systems
- MoH: Music on Hold
- NAMES: NovaTec Administration & Management Element Server
- NLP: NovaTec Link Protocol
- NMP: NovaTec Maintenance Package
- NMS: NovaTec Management Server
- NMS-MC: NovaTec Management Server Maintenance Console
- NPMT: NovaTec Performance Management Tool
- PBUS: Designation of an internal BUS in the NovaTec systems
- PKI: Public Key Infrastructure
- RFC: Request for Comments
- RMCS: RTP Master Clock Server
- RSA: Ronald L. **R**ivest, Adi **S**hamir und Leonard **A**dleman
- RTP: Real Time Protocol
- SCEP: Simple Certificate Enrollment Protocol
- SIP: Session Initiation Protocol
- SRTP: Secured RTP
- SUP4: S0/Up0 (BRI) daughter board with 4 lines
- TDM: Time Division Multiplex
- TELNET:Telecommunication network
- TI: Trace Info
- TI-CA: Trace Info Certificate Authority
- TLS: Transport Layer Security
- ULU: U interface Line Unit
- UDP: User Datagram Protocol
- VoIP: Voice over IP

13   List of illustrations