APPLICATION NOTE 7

Ninthway
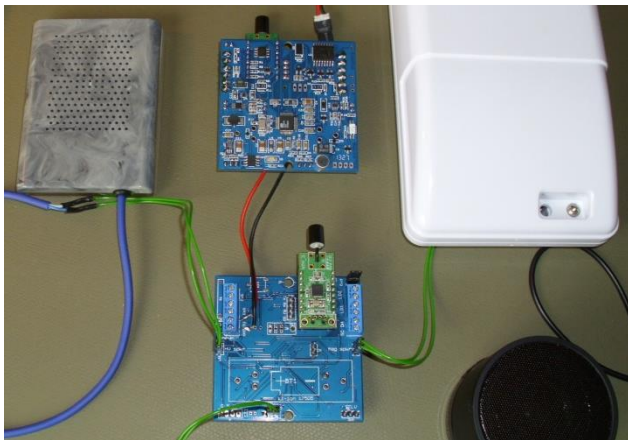Radio
Network
Technology

MANUAL FOR THE NURSE CALL AUDIO STATION

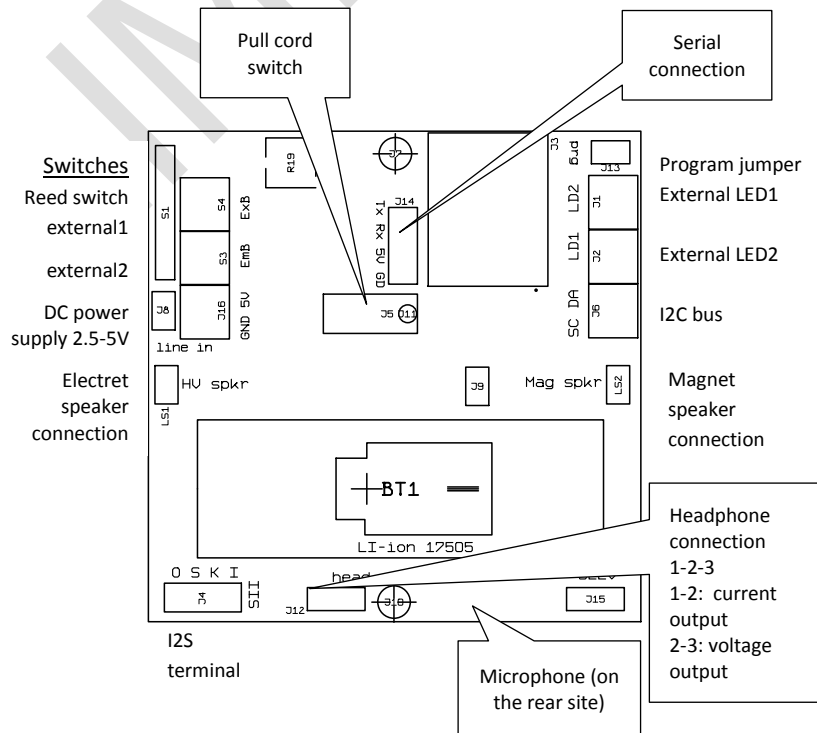| Working with the NCA |
|---|

This call station:

- handles binary input
- plays pre-recorded sound bites
- provides half duplex live audio communication

It provides a 1Vpp line output. It can either drive coil speakers up to 3W or ceramic speakers up to 2.1 W. It can either be used as a (spoken word) sounder, as an announcement device or as an intercom device.

It provides 4 switches, 2 built in and 2 external.

It provides 4 LED indicators, 2 built in and 2 external.

A change of state of one of the inputs triggers the transmission of a data frame with information for the receiving application program.

PCB lay out

Pull cord switch

Serial connection

Switches

Reed switch

external1

external2

DC power supply 2.5-5V

Electret speaker connection

Program jumper
External LED1

External LED2

I2C bus

Magnet speaker connection

Headphone connection
1-2-3
1-2: current output
2-3: voltage output

I2S terminal

Microphone (on the rear site)

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Jumpers	JP8: input connection for line input socket JP12: headphone connection J15: charge select mode 1-2: current; 2-3 voltage controlled
Flavours	The NCA comes with a number of pre settable operation modes called flavours that couple the input signals to the indicators. Change of one or more inputs, triggers and awakes the NCA, depending on the set flavour, to set the indicators and transmit a frame with a two bytes payload. - Byte 0 contains the code for the flavour - Byte 1 contains the status of the extender inputs Also the Alarm flag in de NTM status byte (byte 11) of the data frame is set when an input is activated and reset when an input is deactivated.

Input	Off	Payload byte 1
Pull cord	Change of state input	0000 000X
Emergency button	Change of state input	0000 00X0
Reed switch	Change of state input	0000 0X00
Extra button	Change of state input	0000 X000

Offuse	In the Off-use mode the NCA can be used as a general purpose input device. Channel values from inputs are transmitted in Byte 1 of the data frame. Payload byte 0 = 79
Door	Typical application for the "Door" flavour is the door/window alarm contact. Either use a single magnet mounted directly next to the reed switch or use a separate magnet/switch set and connect it to the external switch terminals. Payload byte 0 = 68

Output	At rest	Activated
LED 1/LED 3 (external)	Off	Off
LED 2/LED 4 (external)	Off	Quick flash

Indicator	The Indicator flavour is meant as wireless over the door side indicator. An NCA can be linked to another NCB or NCA to act as an extra indicator. A NCA with flavour Indicator, will search and synchronize when the reed switch is activated. After the sync with the master is established and the reed switch is released, the periodic timer in the NTM will start periodically a wait-for-beacon-

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	routine and wait for the beacon signal of the linked master. This beacon signal contains the two bytes the tell the status of the master. The Indicator will set it's LED's in accordance with the information in the two bytes. Payload byte 0 = 73
Alarm	Alarm flavour makes the station applicable as an independent two button warning station. Pull cord switch and external button act parallel to button 1. Emergency button act as button 2. Button 1 signals help (twice pulled), button 2 signals emergency. The station is reset by activating the reed switch. Payload byte 0 = 65
Nsalarm Syncalarm	Syncalarm NCA/B broadcasts a beacon signal, Nsalarm does not. They are similar to flavour Alarm, but the buttons are interdependent. Pull cord switch and external button act parallel as button 1. Emergency button acts as second button. Pushing button 1 once or more, generates a help request Pushing button 1 together with 2, generates an emergency request Pushing button 2 only, resets the alarm Payload byte 0 = 78,83
Triple pull	Flavour Triple pull is a variant of the Nurse call flavours. It is about slow or fast pull cord switching. The external switch acts again parallel to the pull cord switch. 1 pull means help

Table under Alarm section:

Output	At rest	Button 1 once	Button 1 twice	Button 2
LED 1/3	Off	Off	Slow flash	Quick flash
LED 2/4	Off	Off	Slow flash	Quick flash

Table under Nsalarm/Syncalarm section:

Output	At rest	Button 1 once	Byte1 twice	Button 1&2
LED 1/3	Off	Slow flash	Slow flash	Quick Flash
LED 2/4	Off	Off	Slow flash	Quick Flash

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<table>
<tr>
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2 pulls within 10 seconds means assistance required
3 pulls within 10 seconds is emergency
2 pulls later than 10 seconds after the last pull resets the system

Alternatives inputs:

Reed switch resets the alarm
Emergency button acts as emergency button

Output	At rest	pulled once	Pulled twice	Pulled trice
LED 1/3	Off	Slow flash	Slow flash	Slow Flash
LED 2/4	Off	Off	Slow flash	Quick Flash
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<tr>
<td>Start up</td>
<td>
At start-up the NTM tests its functionality and reports the successful start of the transceiver by flashing its leds.

The red LED should lit shortly. If it stays on, there is a problem in the NTM.

The green LED lights shortly. When jumper j13 is set (program jumper) the green led will stay on and the NCA cannot go into power down mode.

The NTM then checks for the devices on the NCA.

the I/O extender

The LED controller

The temperature sensor

The shock sensor

The codec

During this check the yellow led stays on.

The NTM sends a string to it's UART to confirm the finding of the elements.

Depending on the setting of flags and j13, the NCA goes into power down mode or stays awake.

The NTM transmits an association message to report itself to an application controller and sometime later a status message.
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<td>Parameters/commands

NCA programming commands</td>
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In addition to the existing commands for the NTM (see application note 1), there are 4 extra commands to set parameters for the nurse call station and 9 extra commands for the VORN function.

TEMP? *CRLF*   returns actual temperature

TMMX? *CRLF*   request temperature threshold

TMMX=n *CRLF*   temperature alarm threshold

DTdt? *CRLF*   request temperature rise setting

DTdt=n *CRLF*   minimum temperature rise alarm
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n= number *CR*= carriage return *LF* = line feed b= bit number 0 – 7 x= 0 or 1 _ = mandatory space	NCFG? *CRLF* request NCB flavour setting NCFG=x *CRLF* setting of the NCB flavour

NCFG? *CRLF*   request NCB flavour setting

NCFG=x *CRLF* setting of the NCB flavour

      x =   O: Offuse   (direct extender I/O)

                D: Door   (door contact)

                I: Indicator (side indicator)

                A: Alarm   (basic call buttons)

                N: Nsalarm (no sync call station)

                T: Tripple   (triple pull call station with beacon emitter for side indicator)

                E: External   (external I2C device)

                S: Syncalarm (with beacon emitter for side indicator)

VORN commands

CPRT? *CRLF*   reports the status of the 4 fixed inputs

CPRTb=x *CRLF* Controls the four switches on NCA board

Function x = 1	n =
Shutdown audio amplifier	4
Shutdown amplifier power supply	5
Shutdown charger	6
Shutdown electret amplifier	7

STST *CRLF*   Plays a test voice prompt.

MLCL *CRLF*   Set up an audio path from microphone input to amplifiers.

VORN? *CRLF* returns the number of the active VORN function.

VORN=n *CRLF* Sets the VORN function.

                n = 0, VORN in idle mode, amplifiers are powered down

                     1, Audio reception, audio signal fed to amplifiers.

                     2, Audio gateway function, microphone connected with network

                     3, Audio gateway function, line input connected with network

                     4, Audio powered down

                     5, Audio powered up

                     6, Audio gateway function, I2S input connected with

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	network
	7, Audio reception, Audio signal to I2S output.
	EDRGn? *CRLF* Returns contents of codec register n.
	EDRGn1=n2 *CRLF* Sets the contents of codec register n1 to n2.
	PLVP_n *CRLF* Plays voice prompt n in codec.
	PLMO_n *CRLF* Plays macro n in codec.
	RDMM_n1_n2 *CRLF* Reads starting from address n1, n2 bytes of the codec flash memory
	STRM_n1_n2 *CRLF* Sends starting from address n1, n2 bytes to the codec flash memory.
Additional information	The NCA is meant to be used as a multipurpose audio receive station, but it is also equipped with a microphone to set up a half-duplex audio link. It's nurse call features are similar to the NCB, but with no auxiliary outputs. It's audio functions are remotely controlled. The NCA can be used to play, in the NCA stored, audio messages or can set up a half-duplex live audio stream between the NCA and an audio gateway.

Using pre-recorded messages.	For the time being pre-recorded messages are supplied to Ninthway, who will incorporate these sound-bites in NCA codec.
	
	In a later stage commands will be available to recordings without the aid of Ninthway CV.
	
	Playing a message starts with powering up the audio circuit.
	VORN=5 //power up the codec.
	Set up an audio path with the play macro command.
	PLMO_4 // setup path between NTM receiver and audio outputs.
	The headphone connection can now feed the audio signal either to a headphone or to an external audio power amplifier.
	
	Activate internal audio power stage amplifier.
	CPRT4=0 //activates the audio amplifier for coil speakers
	Or CPRT7=0 // activates the high voltage audio amplifier for an electret speaker.
	CPRT5=0 //powers up the power supply for the amplifiers.
	
	The NCA is now ready to play the pre-recorded messages in any sequence

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	and as many times as necessary.
	PLVP_n //will send voice prompt n to the audio outputs.
	After the messages are played, the audio circuit can be powered down to save power.
	VORN=4 // will power down the codec, amplifiers and power supply.
Volume control	The audio circuit contains a volume control, that is set to a default attenuation value.
	This volume can be adjusted in step of 0.25 dB via the EDRG command:
	EDRG3=n // default n = 48 but can be chosen between 0 and 255.
	0 means no attenuation.
	255 means 63.75 dB attenuation.
	Setting of the attenuation must be inserted after the VORN=5 command.
Using live audio streaming	Audio streaming has much in common with playing a voice prompt except the audio signal does not come from the audio memory on the NCA but directly from the NTM, transceiver.
	VORN=1 command wakes up the device, sets the audio path and powers up audio amplifiers and power supply.
	The NCA is ready to receive audio frames that an audio gateway puts on the network.
	VORN=0 will put the NCA into an idle state with powered down amplifiers.
	The volume of the sound is determined by the audio level of the broadcasted audio signal in combination with the attenuation setting in register 3 of the codec.
	If required a different attenuation must be set before the audio stream is setup.
	The NCA needs to be powered up to be able to react to the EDRG command.
	VORN=5 // power up codec.
	EDRG3=n //set attenuation.
	VORN=1 // start audio stream reception.
Bidirectional use of the NCA	This is actually similar to live audio streaming but changes direction.
	NCB part of the NCA provides a signal facility from NCA station to a base station.
	The base station receives a button press and will then open an audio stream as explained under Live audio stream.
	To make it possible for a caller to answer, the base station operator sets up a

	path in the NCA from microphone to the NTM transceiver. The caller can speak now.
	Before answers can be given the base station must reroute the audio path from NTM to speaker again and so on.
	Call signal from caller.
	Send VORN=1 //activate audio stream to NCA.
	Send VORN=2 //sets path from microphone to NTM, caller can speak.
	Send VORN=1 //set path from NTM to speaker, base station can speak.
	And so on.
	At the end of the communication the NCA station needs to be powered down to save energy.
	VORN=4 // powers down codec, amplifiers and power supply.
	Two or more NCA's can be set up to form a wireless audio line.
	One NCA is set up to act as gateway, the others as audio receiver stations.
	Audio can be in the form of analogue signals on the microphone, or line input. Or audio can be a digital signal using the I2S gate.
	NCA acting as audio gateway is conditioned with command
	VORN=2 //use microphone as audio source
	VORN=3 // use line input as audio source
	VORN=6 //use I2S as audio source
	NCA acting as a sounder station is conditioned with command:
	VORN=1 //audio to audio amplifiers and headphone connection
	VORN=7 //audio to digital I2S outputs.
	Similar links can be built with the combination of NCA and audio gateway.
Full duplex audio stream	This is possible by setting up two separate audio streams. The VORN system uses the BackBoneNetwork for its transmission. So for full duplex communication at least two BBN frequencies must be used, one for every direction.
	Multiple audio streams can be set up by adding BBN frequencies.
	To achieve that repeaters are required to operate on multiple backbone frequencies. This is under development.

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Samples for remote control of the VORN system.	Activating individual sounder with pre-recorded messages
	RMOT_51_VORN=5_PLMO_4 *CRLF //power up NCA 51 and set audio path*
	RMOT_51_CPRT4=0_CPRT5=0 *CRLF //activate magnet audio amplifier and power supply*
	RMOT_51_PLVP_16 *CRLF //play voice prompt 16*
	RMOT_51 PLVP_16 *CRLF //play voice prompt 16*
	…
	RMOT_51_VORN=4 *CRLF //power down device*
	The same set of commands can be used to control a group of sounders. Simply replace RMOT_51 by CGRP_5. This will control all devices in group 5.
	CGRP_5_VORN=5_PLMO_4 *CRLF //power up NCA's in group 5 and set audio path*
	CGRP_5_CPRT4=0_CPRT5=0 *CRLF //activate magnet audio amplifier and power supply*
	CGRP_5_PLVP 16 *CRLF //play voice prompt 16*
	CGRP_5_PLVP 16 *CRLF //play voice prompt 16*
	…
	CGRP_5_VORN=4 *CRLF //power down device*
	Using the NCA as an audio nurse call station.
	A base station, (a PC) is equipped with a data gateway and there is an audio gateway in the system.
	Via the data gateway a call from a station (let's say 24) is received.
	The audio gateway needs to be set up to produce an audio path from the microphone to the NTM and station 24 needs to be configured as an audio receiver.
	For this application the audio gateway has the number 345.
	RMOT_345_VORN=2 *CRLF // wake up and set audio path from microphone to NTM. The audio gateway starts broadcasting.*
	RMOT_24_VORN=1 *CRLF // Activate NCA as speaker.*
	Audio from base to station is now possible.
	Audio from station to base is achieved by:
	RMOT_345_VORN=1 *CRLF //Audio gateway sends received audio to is speaker outputs.*
	RMOT_ 24_ VORN=2 *CRLF // Station microphone activated.*

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	…
	RMOT_24_VORN=4 *CRLF* // Power down station 24
	RMOT_345_VORN=0 *CRLF* //Put audio gateway in idle mode.

Other literature	Datasheet NTM_3 Datasheet Nurse call audio station Application note 1; programming the NTM Application note 2; Ninthway high secure radio network