

ND48-RS ASCII A2.04 Communication Protocol

ASCII A2.04 protocol provides serial communication with most of the measurement and control devices using ASCII data coding.

Data frame

The table below list all data frame options available in ND-48RS. Many of them may be omitted according to certain application needs.

Configuration frames, which contain no data field can be also sent if display attributes must be changed without changing the data.

„Bytes ignored” listed in the table are not necessary for communication. This option is mentioned due to special function of ND-48RS which allows to ignore specified number of bytes in long data streams.

No	Item name	Decimal value	Byte contents		
			Description	ASCII	Hex vaule
1	Start character ¹⁾	0-255	programmable ⁶⁾		00h-FFh
2	Address ¹⁾⁵⁾	0-255	A1 - most significant digit	'0'-'9',	30h-39h, 41h-46h, 61h-66h
			A0 - least significant digit	'A'-'F',	
3	Decimal point position byte ¹⁾²⁾⁵⁾ (DP_BYTE)	0-255	P1 - most significant digit	'a', 'f'	
			P0 - least significant digit		
4	Configuration byte ¹⁾⁵⁾ (CONF_BYTE)	0-255	K1 - most significant digit		
			K0 - least significant digit		
5	Bytes ignored before the data ¹⁾⁸⁾		X1		
			...		
			Xq		
6	Data ³⁾⁴⁾	1-32	D 1 (First character from the left)		20h-FFh
			D 2		
			...		
			D i		
			...		
			D N (last character) ⁴⁾		
7	Bytes ignored after data ¹⁾⁸⁾		Y1		
			...		
			Yr		
8	End character	0-255	programmable ⁶⁾ (different then start character)		00h-FFh

¹⁾ - Applicable if appropriate setting in the display was made

²⁾ – Several decimal points can be received and displayed:

Digits	12345							
Bit No	b0	b1	b2	b3	b4	b5	b6	b7
Bit Value	0	0	1	0	1			
Result	123.45.							

³⁾ – Codes above 0x7F are decoded to BLANK (20h)

⁴⁾ – Byte number according to Fc12 function setting. If “--” is set data length is not controlled – the data is received till end character occurrence.

⁵⁾ – Two hex digits.

⁶⁾ – Start and End character can not be used inside the frame. Each occurrence will be decoded as frame start or end. Start and End characters must be different.

Configuration frame

Configuration frames, which contain no data field can be also sent if display attributes must be changed without changing the data. Such frame must contain all other frame fields present in normal data frame. Configuration frame is received despite data field length control (function Fc12).

Programming

The table shows menu options accessible in ND-48RS with the use of build-in push-buttons. Programming menu is activated by closing S3 pins with a jumper. S1 key scrolls the menu and changes the values. S2 key is used for function enter and value accept.

Menu function	Description	Options / value range	Default setting
Fc01	Device address	00h -FFh (" - " - no address)	'--'
Fc02	Transmission speed	1200, 2400, 4800, 9600, 14400, 19200 bps	9600
Fc03	Parity	b -no parity bit P -even parity n -odd parity 0 -fixed 0 1 -fixed 1	b
Fc04	Stop bits	1, 2	1
Fc05	Protocol	0 - (inactive)	0
Fc06	Timeout	0-255 ; time= value *100ms (0 – no time-out)	0
Fc07	Decimal point byte handling (DP_BYTE)	n – no handling F – DP_BYTE handling	n
Fc08	Configuration byte handling (CONF_BYTE)	n – no handling, t – CONF_BYTE handling	n
Fc09	Start character	00h – FFh (" - " - no start chr)	02h (STX)
Fc10	End character	00h –FFh or 0Dh,0Ah (CR,LF) (different than start character)	03h (ETX)
Fc11	Bytes ignored before the data	0-255	0
Fc12 ¹⁾	Data length (byte number) including decimal point	0 - 32 (" - " - no length control)	5
Fc13	Bytes ignored after the data	0-255	0
Fc14	Error messaging	t – yes, transmission and frame format messaging n – no, no change in displayed data	n
Fc15	Display blank	0-255 (minutes of time-out) 0 – no time-out	0
Fd01	Display brightness	25%, 50%, 75%, 100%	100%
Fd02	Justification	inactive	
Fd03	Leading zeros formatting ²⁾	Z – suppressed, R – not suppressed	Z
Fd04	Fixed decimal point	0; 0.0; 0.00; 0.000; 0.0000	0
Fd05	Display segment test	all segments lit	

1) - if the data string is shorter than physical display length it will be displayed with left justify
- if the data string is longer than physical display length the extra characters will be rejected. Suppressed zeroes cause are taken into account - there blank positions in their place.

2) Leading zeros algorithm suppresses all zeros before first digit or leaves always one zero before decimal point. If „-“ sign is received it is displayed in front of first digit.

Broadcast addressing

Frames with **0 (00h)** address are received by all ND-48RS devices regardless to address programmed. This way the information dedicated to all devices in the net may be sent in one frame. Devices with „--” address setting do not decode address bytes and will not receive broadcast information.

Configuration byte structure

Bit	Meaning	Description
b0	blinking	0 – blinking off; 1 – blinking on
b2,b1	brightness	00 – 100%, 01 – 75%, 10 – 50%, 11 - 25%
b3	sound	<i>inactive</i>
b5,b4	color	<i>inactive</i>
b6	blank	0 – no change, 1 – blanked
b7	-	reserve

Decimal point formatting

Decimal point can be controlled in three different ways:

- by setting it in fixed position with Fd04 menu function,
- by sending DP information in DP_BYTE, (*this method does not change frame length and is useful if DP can not be included data string*)
- by including ASCII dot (coma) code in required position in data string. The decimal point is glued to the preceding it digit.
Decimal point must be taken into account when setting date field length in Fc12 menu function (digit number + 1).

7-segment representation of ASCII characters

ND-48RS displays most of ASCII characters from the range of 20h to 7Fh. Specific representation on 7-segment LED displays shows the table below. The characters from the range 80H to Ffh are interpreted as blank (20h). 00h-1Fh range is reserved for control codes.

ASCII table

20h 32d		30h 48d		40h 64d		50h 80d		60h 96d		70h 112d	
21h 33d		31h 49d		41h 65d		51h 81d		61h 97d		71h 113d	
22h 34d		32h 50d		42h 66d		52h 82d		62h 98d		72h 114d	
23h 35d		33h 51d		43h 67d		53h 83d		63h 99d		73h 115d	
24h 36d		34h 52d		44h 68d		54h 84d		64h 100d		74h 116d	
25h 37d		35h 53d		45h 69d		55h 85d		65h 101d		75h 117d	
26h 38d		36h 54d		46h 70d		56h 86d		66h 102d		76h 118d	
27h 39d		37h 55d		47h 71d		57h 87d		67h 103d		77h 119d	
28h 40d		38h 56d		48h 72d		58h 88d		68h 104d		78h 120d	
29h 41d		39h 57d		49h 73d		59h 89d		69h 105d		79h 121d	
2Ah 42d		3Ah 58d		4Ah 74d		5Ah 90d		6Ah 106d		7Ah 122d	
2Bh 43d		3Bh 59d		4Bh 75d		5Bh 91d		6Bh 107d		7Bh 123d	
2Ch 44d		3Ch 60d		4Ch 76d		5Ch 92d		6Ch 108d		7Ch 124d	
2Dh 45d		3Dh 61d		4Dh 77d		5Dh 93d		6Dh 109d		7Dh 125d	
2Eh 46d		3Eh 62d		4Eh 78d		5Eh 94d		6Eh 110d		7Eh 126d	
2Fh 47d		3Fh 63d		4Fh 79d		5Fh 95d		6Fh 111d		7Fh 127d	

Ilustracja 1

Examples:

1. The simplest data frame

The data and ending character only.

No	Parameter		Byte content		
	Name	Decimal value	Description	ASCII	Hex value
1	Data	32-127	D 1 (Char. 1)(first from the left)		20h-7Fh
			D 2 (Char. 2)		
			D 3 (Char. 3)		
			D 4 (Char. 4)		
			D 5 (Char. 5)		
2	End character	13	CR	CR	0Dh

Example:

1	2	0	0	0	CR
---	---	---	---	---	----

On the display: **12000**

Data length is set to 5 and end character to CR.

2. Frame with address field and configuration byte

This frame contains start character, address, configuration byte, data and end character.

No	Parameter		Byte contents		
	Name	Decimal vaue	Description	ASCII	Hex value
1	Start character	27	STX	STX	02h
2	Address	1-255	A1 – most significant digit	'0'-'9', 'A'-'F'	30h-39h, 41h-46h
			A0 – least significant digit		
3	Configuration byte CONF-BYTE	0-255	K1 - most significant digit		
			K0 - least significant digit		
4	Data	32-127	D 1 (Char. 1)(first from the left)		20h-7Fh
			D 2		
			D 3		
			D 4		
			D 5		
5	End character	13	ETX	ETX	03h

Examples:

1. 1234 data, right justified on 08h address device:

STX	0	8	0	0	BLANK	1	2	3	4	ETX
-----	---	---	---	---	-------	---	---	---	---	-----

2. 1234 data, right justified on 1Fh address device:

STX	1	F	0	0	8	7	4	5	BLANK	ETX
-----	---	---	---	---	---	---	---	---	-------	-----

3. Display blinking on 1Fh address device:

STX	1	F	0	0	ETX
-----	---	---	---	---	-----

4. Blank all displays:

STX	0	0	4	0	ETX
-----	---	---	---	---	-----

5. 12345 value on 27h address device:

STX	2	7	0	0	1	2	3	4	5	ETX
-----	---	---	---	---	---	---	---	---	---	-----

3. Frame with ignored bytes

Byte ignoring function is useful if data stream is long and contains the data not needed for ND-48RS. The position of required data must be checked and adequate number of ignored bytes programmed in functions Fc11 and Fc13.

No	Parameter		Byte contents		
	Name	Decimal value	Description	ASCII	Hex value
1	Start character	2	ESC	ESC	1Bh
2	Bytes ignored before the data		B1		
			B2		
			B3		
			B4		
3	Data	32-127	D 1 (Char. 1)(first from the left)		20h-7Fh
			D 2		
			D 3		
			D 4		
			D 5		
4	End character	3	CR	CR	0Dh

Example:

12345 value cut from following string:

ESC	0	8	0	3	1	2	3	4	5	CR
-----	---	---	---	---	---	---	---	---	---	----

In this example 4 bytes ignored before the data are set. Start character is set to ESC. End character to CR. Any data excluding ESC and CR codes are allowed in the range of ignored data.

Document version: ASCII A2.04 r02 ENG 26.04.2007.