INSTRUCTION MANUAL

Network Clock Interface NCI

GPS 4500
Satellite Receiver

NTP-Server /
Commissioning Tool

NTP-Server /
Season-Server

LAN

Network
Clock Interface

Digital Clocks

Network
Clock Interface

Network
Clock Interface

Analogue Clocks

Master Clocks
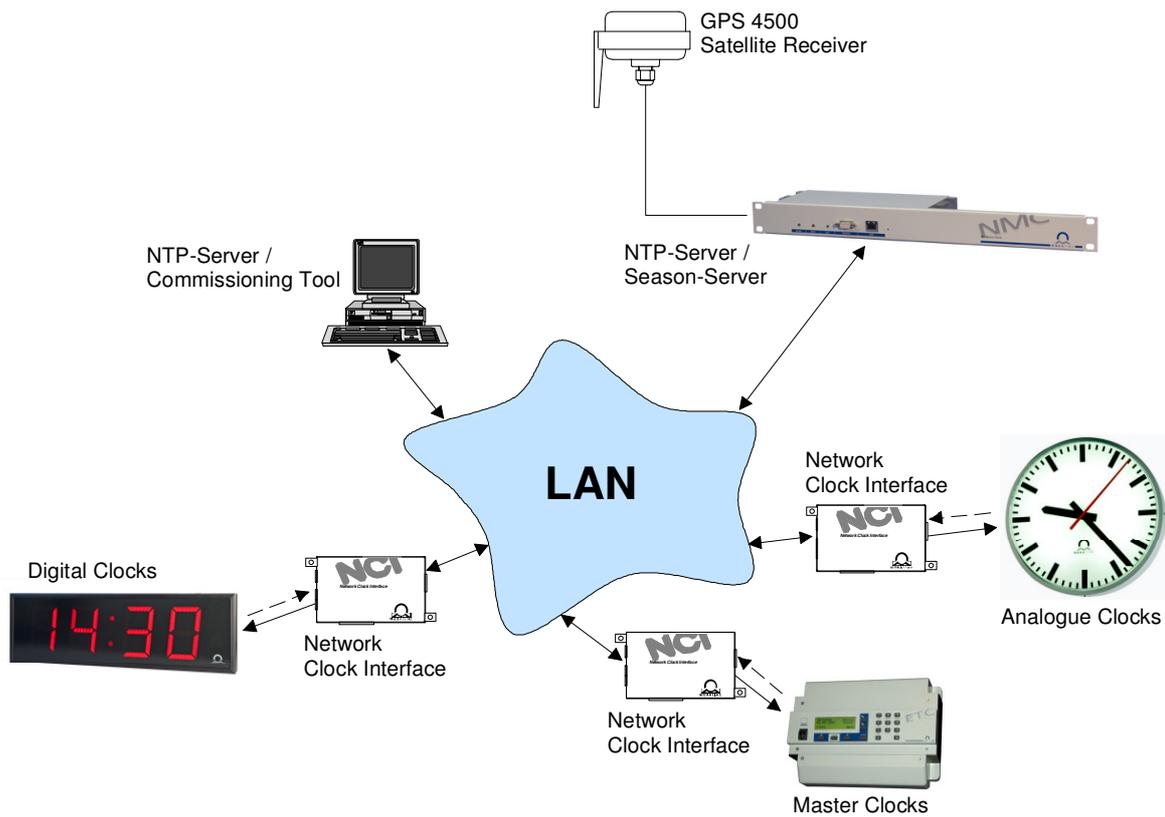
Certification of the Producer

$C \epsilon$

STANDARDS
The Network Clock Interface NCI has been developed and produced in accordance with the EU standards
89 / 336 / EWG

References to the Instruction Manual

1. The information in this instruction manual can be changed at any time without previous notice.
   The current version is available for downloading under www.mobatime.com.
2. This instruction manual has been composed with utmost care, in order to explain all details in respect of the operation of the product. Should you, nevertheless, have questions or discover errors in this manual, please contact us.
3. We do not answer for direct or indirect damages, which could occur, when using this manual.
4. Please read the instructions carefully and start the setting-up of the product, only once you have correctly understood all information for the installation and of the operation.
5. The installation must only be carried out by skilled staff.
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Contents

1　Introduction

The Network Clock Interface (NCI) provides NTP synchronisation to most types of MOBATime slave clocks and master clocks. The easy way of commissioning, its high performance at very low cost and its small dimensions make it suitable for most new or existing LAN Ethernet installations.

2   Hardware Description
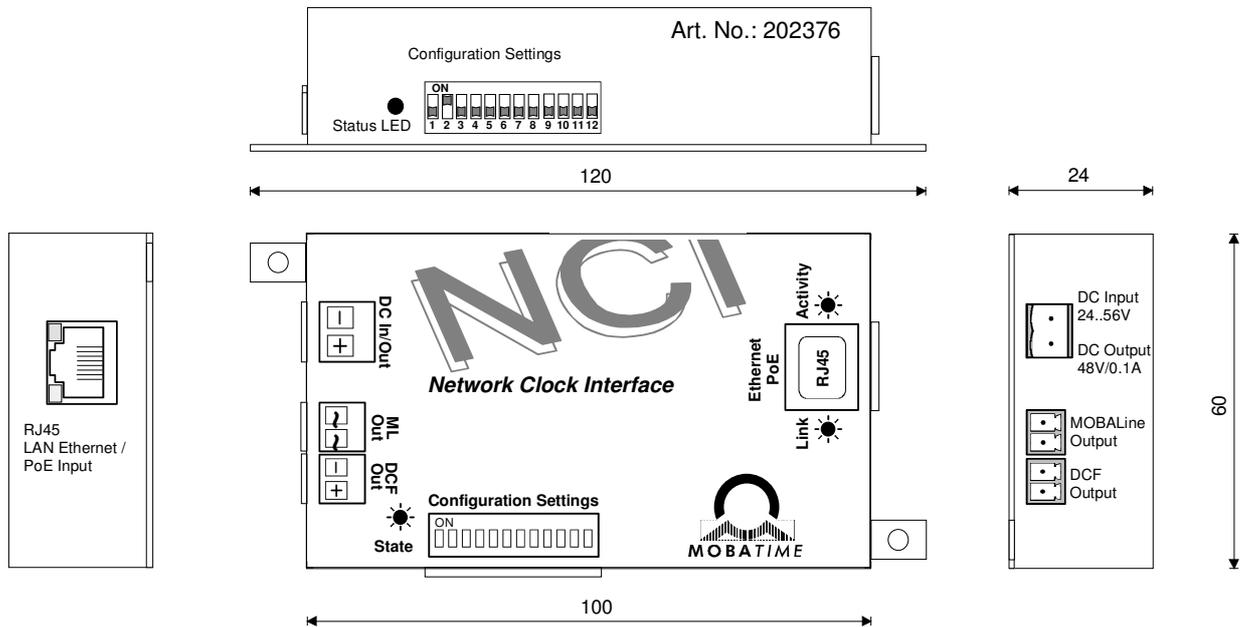
2.1   Connectors

LAN Ethernet 10Mbit/s
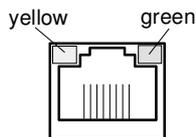
RJ 45 connector for 10BaseT cable

Integrated LEDs:

Green: Link (connection to LAN established)
Yellow: Activity (send / receive packets)

Power over Ethernet (PoE) capable connector. The NCI can be fed by PoE phantom power or over the pins 4,5 and 7,8 (rectifier on board).

Time Code Outputs

MOBALine:

- Frequency modulated MOBALine time code for self-setting slave clocks (e.g. SAM 00, MLU 190).

- Time format: Local time.

- Electrical characteristics: 15V / 50Hz / 20mA max.

DCF 77:

- Synthetic DCF serial time code for self-setting slave clocks (e.g. BU 190).

- Time format: Local time.

- Electrical characteristics: Passive current loop interface.
Optocoupler:
$U_{max}=30V$, $I_{on}=10..15mA$, $I_{off}=2mA$ @ 20V.

Power Supply

This connector can either be used as an input to feed the NCI by an external DC power supply when no PoE (Power over Ethernet) is available on the Ethernet cable or it can be used as a DC output to feed an external device (e.g. small digital clock with 48V DC input). In the latter case it is mandatory that the NCI is powered by PoE.

- Electrical input characteristics: 24..56V direct current
Current consumption with MOBALine load: <100mA @24V, resp. <50mA @48V

- Electrical output characteristics: 48V / 100mA max.

State LED

When applying power to the NCI the state LED illuminates. As soon as the NCI has been synchronised and starts to output the DCF time signal, the state LED flashes once per second, indicating normal operation. After 24 hours without receiving any NTP packet from the time server, the LED will be illuminated continuously again.

3 Synchronisation

3.1 Time Server

The Network Clock Interface reads NTP (Network Time Protocol) packets from a time server within the LAN. As the NCI only needs Multicast messages from a time server, no specific IP address has to be programmed. Only the last part of the Multicast IP address has to be selected by means of DIP switches. The time server provides the packet on the following Multicast IP address (administratively scoped IPv4 multicast address):

239.192.54.nnn   (nnn = 1..15, selectable by configuration switches 1 to 4)

The interval the time server outputs the NTP packets can be chosen freely (e.g. twice per minute). For the first synchronisation the NCI needs 2 valid packets. Afterwards 10 successive packets are needed to change the time on the NCI. This high number of packets is defined to avoid the acceptance of invalid time information.

3.2 Accuracy

The output time has an accuracy of +/-20ms.

3.3 Time Zone Entry

Per definition NTP contains UTC (Coordinated Universal Time). To be able to output the local time the NCI needs a time zone entry to compute the local time offset that is added to UTC.

3.3.1 Standard Time Zone Table

The interface provides a time zone table with 56 standard entries. The suitable entry can be selected by configuration switches 5 to 10.

When using a standard time zone entry ensure that switch 11 is set to position OFF.

3.3.2 Season Server

It is possible to add a season server to the LAN (e.g. Net Master Clock NMC) which provides up to 15 different time zone entries to the NCI. The suitable entry can be selected by configuration switches 5 to 10.

The season server must use the same IP multicast address as the time server to distribute the time zone packets. Usually the season server works as a NTP time server at the same time.

When using a time zone entry from a season server ensure that switch 11 is set to position ON.

4 Configuration

4.1 Configuration Switches

The NCI offers 12 DIP switches which can be used to do the described configurations:

Switches 1..4: Selection of the IP multicast address which is used by the time server to distribute the NTP packets. The used IP address is 239.192.54.nnn (nnn = 1..15, 0 = reserved).

When using a season server it has to use the same IP multicast address as the time server to provide its time zone entries to the NCI.

Switches 5..10: Selection of 1 out of 56 standard time zone entries. Invalid settings (> 56) result in UTC output.

When using a season server the switches are used to select 1 out of 15 time zone entries. Invalid settings (0 or > 15) result in UTC output.

Switch 11: Specifies whether a season server provides a time zone entry automatically to the NCI.

Switch 12: Forces MOBALine synchronised clocks for maintenance or commissioning to run to the 12:00 position.
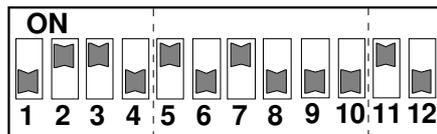
Example setting:

1..4: IP multicast address 239.192.54.6
5..10: Time zone entry number 5
11: Time zone entry from season server

Switch:	State:	Function:
1	ON	Selection of IP multicast address. Significance 1
	OFF	Selection of IP multicast address. Significance 0
2	ON	Selection of IP multicast address. Significance 2
	OFF	Selection of IP multicast address. Significance 0
3	ON	Selection of IP multicast address. Significance 4
	OFF	Selection of IP multicast address. Significance 0
4	ON	Selection of IP multicast address. Significance 8
	OFF	Selection of IP multicast address. Significance 0
5	ON	Selection of time zone entry. Significance 1
	OFF	Selection of time zone entry. Significance 0
6	ON	Selection of time zone entry. Significance 2
	OFF	Selection of time zone entry. Significance 0

7	ON	Selection of time zone entry. Significance 4
	OFF	Selection of time zone entry. Significance 0
8	ON	Selection of time zone entry. Significance 8
	OFF	Selection of time zone entry. Significance 0
9	ON	Selection of time zone entry. Significance 16
	OFF	Selection of time zone entry. Significance 0
10	ON	Selection of time zone entry. Significance 32
	OFF	Selection of time zone entry. Significance 0
11	ON	Use time zone entry from season server
	OFF	Use time zone entry from standard time zone table
12	ON	Run to 12:00 position (MOBALine command)
	OFF	On time (MOBALine command)

5 Commissioning

5.1 Step by Step

1 Every Network Clock Interface has a unique MAC address which is printed on the housing. The location of the NCI and its MAC address should be noted and preserved for future identification of the device.

The MAC address has the following 6 Byte hexadecimal format:

00-16-91-nn-nn-nn (nn = individual)

2 Set the desired configuration on DIP switches 1 to 12.

3 Connect the Network Clock Interface to the clock which shall be synchronised:
- DCF output or MOBALine output.
- DC output if the clock is fed by the NCI.

4 Power Supply 1 (Power over Ethernet):

Connect the Ethernet cable to the NCI. There must be a PoE capable device connected to the LAN connection of the NCI (e.g. switch or PoE mains adapter). Proceed to step 7.

5 Connect the Ethernet cable to the NCI.

6 Power Supply 2 (External DC supply)

Connect an external DC power supply or the DC output of the clock (if available) to the DC input of the NCI.

7 Check normal operation:
- State LED illuminates, indicating availability of power supply.
- Yellow link LED illuminates, indicating established link to the LAN.
- Green activity LED flashes, indicating reception of Ethernet packets.
- If the NCI receives NTP Multicast packets and is able to synchronize the state LED starts flashing once per second, indicating output of time code signal.

8 The synchronisation of a DCF clock lasts approximately 3 minutes after the state LED of the NCI started blinking. The synchronisation of a MOBALine clock lasts about 15 seconds.

Remark: To record and analyze the data communication over the network, we propose to use the freeware analysis tool Wireshark (www.wireshark.org).
To check current state of Multicast devices in the network we propose to use the MOBATime software Network Device Manager NDM.

6 Internet Group Management Protocol (IGMP)

6.1 Use

Often multiple networks are connected by routers. It is possible that the time/season server(s) and the NCI do not always belong to the same network. The NCI will therefore periodically report its interest in receiving packets addressed to a specific multicast address (239.192.54.nnn) to neighbouring multicast routers. The protocol used to report the IP multicast group membership to the router is called Internet Group Management Protocol (IGMP). As long as the router receives membership report messages from the NCI it will forward the packets addressed to the specified multicast address to the interface. Due to compatibility reasons the NCI uses IGMP version 2.

The protocol is automatically sent every 3 minutes using the following dummy IP address:

1.255.255.253

Warning: Take care that no other network members are using this IP address!

7   Time Zone Table

Time zone entries in the standard season table (version 9.0).

Time zone	City / State	UTC Offset	DST Change	Standard → DST	DST → Standard
00	UTC (GMT), Monrovia, Casablanca	0	No		
01	London, Dublin, Edinburgh, Lisbon	0	Yes	Last Sun. Mar. (01:00)	Last Sun. Oct. (02:00)
02	Brussels, Amsterdam, Berlin, Bern, Copenhagen, Madrid, Oslo, Paris, Rome, Stockholm, Vienna, Belgrade, Bratislava, Budapest, Liubliana, Prague, Sarajevo, Sofia, Vilnius, Warsaw, Zagreb	+1	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
03	Athens, Istanbul, Minsk, Helsinki, Riga, Tallinn, Kaliningrad	+2	Yes	Last Sun. Mar. (03:00)	Last Sun. Oct. (04:00)
04	Bucharest, Romania	+2	Yes	Last Sun. Mar. (03:00)	Last Sun. Oct. (04:00)
05	Cairo, Pretoria, Harare	+2	No		
06	Dhaka	+6	Yes	Wed. 31. Mar. (22:59) (2010)	Sun. 31. Oct. (23:59) (2010)
07	Tel Aviv	+2	Yes	Last Fri. Mar. (02:00)	2nd Sun. Oct. (02:00) (2010)
08	Kuwait City	+3	No		
09	Moscow, St. Petersburg, Volgograd	+3	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
10	Tehran	+3.5	Yes	Sun. 21. Mar. (00:00) (2010)	Tue. 21. Sep. (00:00) (2010)
11	Abu Dhabi, Muscat, Tbilisi	+4	No		
12	Kabul	+4.5	No		
13	Yekaterinburg, Russia	+5	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
14	Tashkent	+5	No		
15	Mumbai, Calcutta, Madras, New Delhi, Colombo	+5.5	No		
16	Astana, Thimphu	+6	No		
17	Bangkok, Hanoi, Jakarta	+7	No		
18	Beijing, Chongqing, Hong kong, Singapore, Taipei, Urumqi	+8	No		
19	Tokyo, Osaka, Sapporo, Seoul	+9	No		
20	Yakutsk, Russia	+9	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
21	South Australia: Adelaide	+9.5	Yes	1st Sun. Oct (02:00)	1st Sun. Apr. (03:00)
22	Northern Territory: Darwin	+9.5	No		
23	Queensland: Brisbane, Guam, Port Moresby	+10	No		
24	NSW, Victoria: Sydney, Canberra, Melbourne	+10	Yes	1st Sun. Oct. (02.00)	1st Sun. Apr. (03:00)
25	Tasmania: Hobart	+10	Yes	1st Sun. Oct. (02:00)	1st Sun. Apr. (03:00)
26	Vladivostok	+10	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
27	Solomon Is. , New Caledonia	+11	No		

				Standard → DST	DST → Standard
28	Auckland, Wellington	+12	Yes	Last Sun. Sep. (02:00)	1st Sun. Apr. (03:00)
29	Marshall Is.	+12	No		
30	Azores	-1	Yes	Last Sun. Mar. (00:00)	Last Sun. Oct. (01:00)
31	Middle Atlantic	-2	No		
32	Brasilia	-3	Yes	3rd Sun. Oct. (00:00)	3rd Sun. Feb. (00:00) (2010)
33	Buenos Aires	-3	No		
34	Newfoundland, Labrador	-3.5	Yes	2nd Sun. Mar. (00:01)	1st Sun. Nov. (00:01)
35	Atlantic Time (Canada)	-4	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
36	La Paz	-4	No		
37	Bogota, Lima, Quito	-5	No		
38	New York, Eastern Time (US & Canada)	-5	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
39	Chicago, Central Time (US & Canada)	-6	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
40	Tegucigalpa, Honduras	-6	No		
41	Phoenix, Arizona	-7	No		
42	Denver, Mountain Time	-7	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
43	Los Angeles, Pacific Time	-8	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
44	Anchorage, Alaska (US)	-9	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
45	Honolulu, Hawaii (US)	-10	No		
46	Midway Islands (US)	-11	No		
47	Mexico City, Mexico	-6	Yes	1st Sun. Apr. (02:00)	Last Sun. Oct. (02:00)
48	Samara, Russia	+4	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
49	Novosibirsk, Russia	+6	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
50	Krasnoyarsk, Russia	+7	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
51	Irkutsk, Russia	+8	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
52	Magadan, Russia	+11	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
53	Anadyr, Russia	+12	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
54	Ittoqqortoormiit, Greenland	-1	Yes	Last Sun. Mar. (00:00)	Last Sun. Oct. (01:00)
55	Nuuk, Greenland	-3	Yes	Last Sat. Mar. (22:00)	Last Sat. Oct. (23:00)
56	Qaanaaq, Greenland	-4	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
57	Western Australia: Perth	+8	No		
58	Caracas	-4.5	No		
59	CET standard time	+1	No		
60	Santiago, Chile	-4	Yes	2nd Sun. Oct. (00:00)	2nd Sun. Mar. (00:00)
61	Chile, Easter Island	-6	Yes	2nd Sat. Oct. (22:00)	2nd Sat. Mar. (22:00)
62	Baku	+4	Yes	Last Sun. Mar. (04:00)	Last Sun. Oct. (05:00)
63	Islamabad, Karachi, Pakistan	+5	No	Thu. 15. Apr. (00:00) (2010)	Sun. 31. Oct. (00:00) (2010)
64	Apia, Samoa	-11	Yes	Last Sun. Sep. (00:00)	First Sun. Apr. (00:00) (2011)

Legend:

UTC:	Universal Time Coordinate, equivalent to GMT
DST:	Daylight Saving Time
DST Change:	Daylight Saving Time changeover
Standard → DST:	Time change from Standard time (Winter time) to Summer time
DST → Standard:	Time change from Summer time to Standard time (Winter time)

Example:

2nd last Sun. Mar. (02:00)	Switch over on the penultimate Sunday in March at 02.00 hours local time.

⚠ **Attention:** As usual, the time table is adapted each year. You can download the newest time table from our homepage: *www.mobatime.com* ➔ *Downloads* ➔ *Moba-Software* ➔ *Time Zone Table*.
If the delivered device contains a newer version as showed in this manual, it's recommended to check the time zone entries.

8   Technical data

Ethernet connection:	Ethernet controller 10Mbit/s ModJack RJ45 with integrated LED (activity, link).
Processor:	Single Chip FLASH Processor 1 kB RAM, 24 kB FLASH, external serial EEPROM 1 kb
Synchronization:	Over LAN, via Network Time Protocol (NTP), UTC
Time code outputs	MOBALine: local time, 15 V / 50 Hz / 20 mA max. DCF: passive current loop, Optocoupler: U_{max} = 30 V, I_{on} = 10..15 mA, I_{off} = 2 mA @20 V
Output accuracy:	+/-20 ms (synchronized)
Time keeping:	Autonomous operation on quartz basis over 24 hrs
Power supply:	DC input: 24..56 VDC, or PoE: 48 V (Phantom / Pins 4,5 and 7,8)
Current consumption:	<100 mA @24 V / <50 mA @48 V
Configuration:	12 x DIP switches
Display elements:	1 x state LED
Temperature range:	-30..+70 °C, 10-90% relative humidity, without condensation
Casing:	Stainless steel, bottom 1 mm, top 0.5 mm, printed. Ears for wall mounting
Dimensions:	120 x 60 x 24 mm (l x w x h), Weight: approx. 200 g

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