BeFREE 10

10.4” Touchcomputer with Integrated InterCom

TECHNICAL OVERVIEW

Description and Application

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[TIPRO®]

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A. GENERAL INFORMATION

The **BeFREE 10** (BF 10) is a member of the FREE/FREE+/BeFREE modular product family, integrating a 10.4" touchmonitor, an industrial computer and an intercom device. It is compatible and combinable with all existing FREE/FREE+ modules.

The display is an industrial grade, high (XGA) resolution, ultra-wide viewing angle TFT LCD with LED backlight. The computer is based on an industrial embedded mainbord with Intel dual-core **Atom** processor (**D525**). Thanks to low-power components and specific electronic and thermal design the BeFREE 10 is completely silent and without moving parts.

The Intercom section consists of a goose-neck microphone, illuminated PTT key, stereo loudspeakers, volume control knob and VU-meter. Both analogue and USB audio can be used as input to the loudspeakers, resulting in up to four (4) listening channels.

A.1. Highlights

FEATURES

- space-saving integration of a fanless Touchcomputer and an Intercom (functionally equivalent to a combination of BeFREE 15 and Speakerbox)
- modular – combinable with other FREE/FREE+ add-on modules into multifunctional terminals
- low-profile horizontal design - no obstruction of the view
- silent and reliable - no moving parts, industrial grade components, Ethernet redundancy
- extensive connectivity (LAN, USB, COM, external display, Tipro bus, digital inputs)
- built-in Tipro controller enables:
  - modularity
  - energy saving modes
  - touchscreen disable/enable control
  - brightness adjustment, manual and automatic
  - four programmable keys
  - two programmable external digital inputs
- stereo loudspeakers (2 x 2W) with volume control knob
- goose-neck microphone with illuminated PTT key
- three-colour bar-graph display
- three mechanical keys for brightness control and other functions
- several LED indicators (power, SSD, microphone, touchscreen ...)

- cable management – hidden and secured, but accessible
- optional Inclination Mechanism (VESA 75)

APPLICATIONS

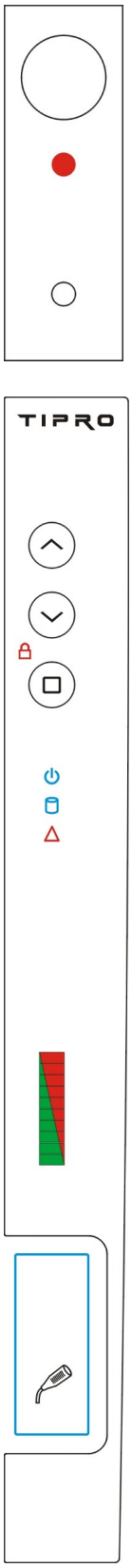
- operator/dispatcher terminals for command and control centres in:
  - transport and traffic control (railways, air traffic …)
  - public safety (police, fire brigades, ambulance …)
  - utilities (electricity, gas ...)
  - building management systems (automation, safety, security …)
- trading and banking consoles
- multifunctional control panels

A.2. Operator Interface

Figure A.1 Operator Interface of BeFREE10

A.3. The Stripe (Keys & Indicators)

The stripe (see Figure A.2 below) is an ergonomically designed vertical area along the right-hand side of the display. It comprises a number of visual indicators and mechanical keys with a proper tactile feedback in order to provide the operator with a quick insight and immediate access to important controls. The most prominent position is assigned to the PTT key, which consists of two full-travel mechanical key-switches and a large actuator with dimmable background illumination.



Microphone LED	Illuminated (red) when the microphone is active.
Ambient Light Sensor	Active when automatic brightness control is set.
Brightness UP Key	Press to increase brightness of the display and LED indicators. Actual brightness level is shown on the VU meter in orange colour.
Brightness DOWN Key	Press to decrease brightness of the display and LED indicators.
Home / TouchDisable Key	Long press disables touchscreen. The LED indicator (lock) is illuminated (red) when touch is disabled. Short press (re)enables touchscreen.
Status Indicators	Power, Disk Activity and Warning. More information in chapter B.9 LED Indicators
Bar-Graph Display	Green: loudspeakers volume level Red: VU-meter (signal level at the loudspeakers) Orange: display brightness level
PTT (Push To Talk) Key	By default PTT, but can be set to PTM (Push To Mute) or any other key event. Blue backlight can be programmed to blink or turn ON/OFF upon press/release.

Figure A.2 The Stripe (Keys & Indicators)

A.4. Integral Parts

Major components inside BeFREE 10 are the following:

- Embedded Mainboard. The processor and south bridge are soldered on the board. RAM is placed in the socket. The display is connected via LVDS. The Tipro controller, touchscreen controller and audio board (USB audio) are connected via USB. Besides to USB, the Tipro controller is also connected to COM 2. Next to USB audio, the analogue audio (line-out) of the integrated soundcard is connected to the audio board. Data is stored on the Solid State Disk (SSD) with SATA II interface.
- Tipro Board. This electronics comprises a full-speed USB Hub, the Tipro controller and the touchscreen controller. The Tipro controller and the touchscreen controller are connected to the internal USB Hub, which is connected to the mainboard. The Tipro controller manages power and provides for the programmability of the connected Tipro modules. It also controls several inputs and outputs. The inputs are, for instance, key-presses that are translated into different programmable actions, such as disabling the touchscreen or sending HID events to the Operating System. Typical outputs are LED indicators.
  - Digital Inputs. Two programmable digital inputs are available, one (A) galvanically isolated via an opto-coupler, another (B) not.

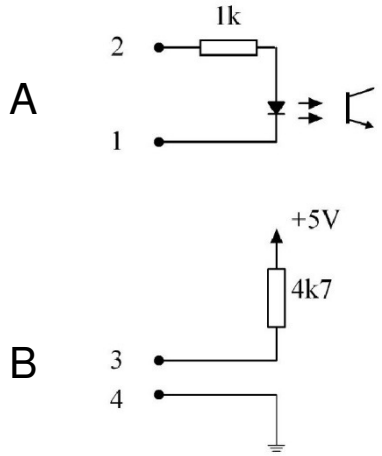


Figure A.3 Digital Inputs

- Audio Board. Its functional block diagram is shown in Figure A.4 below. Left (Voice) and Right (Alert) Speaker are physically/electrically realized as two loudspeakers in parallel to double the output volume. Internal signal processing includes analogue-to-digital and digital-to-analogue conversion (block "USB AUDIO CODEC"), conditioning (amplification, attenuation, filtering …), sensing and switching. The complete processing is programmable via ChangeMe software and can be dynamically modified during the operation in so-called On-Line

operating mode. USB and analogue signals can be mixed, resulting in up to four listening (output) audio channels (2 x stereo signals). The Echo-Cancellation circuitry is optional (see Chapter E.3 for more details).

- Microphone Amplifier. This is a logarithmic audio amplifier with programmable gain, noise gating threshold and compression ratio. Noise gating feature enables ambient noise to be suppressed. All sounds below the threshold are removed inside the amplifier, so with higher threshold the microphone needs to be used closer to the mouth and speech needs to be louder to get through the amplifier. The compression feature enables compression of the output signal dynamics in order to minimize the difference between quiet and loud speech. The amplifier is also capable of limiting extremely loud speech thus preventing distortion and popping. The overall gain can be even lower than one (i.e. attenuation) as well as equal to zero (i.e. totally muted input). Also the range of the goose-neck microphone can be adjusted.

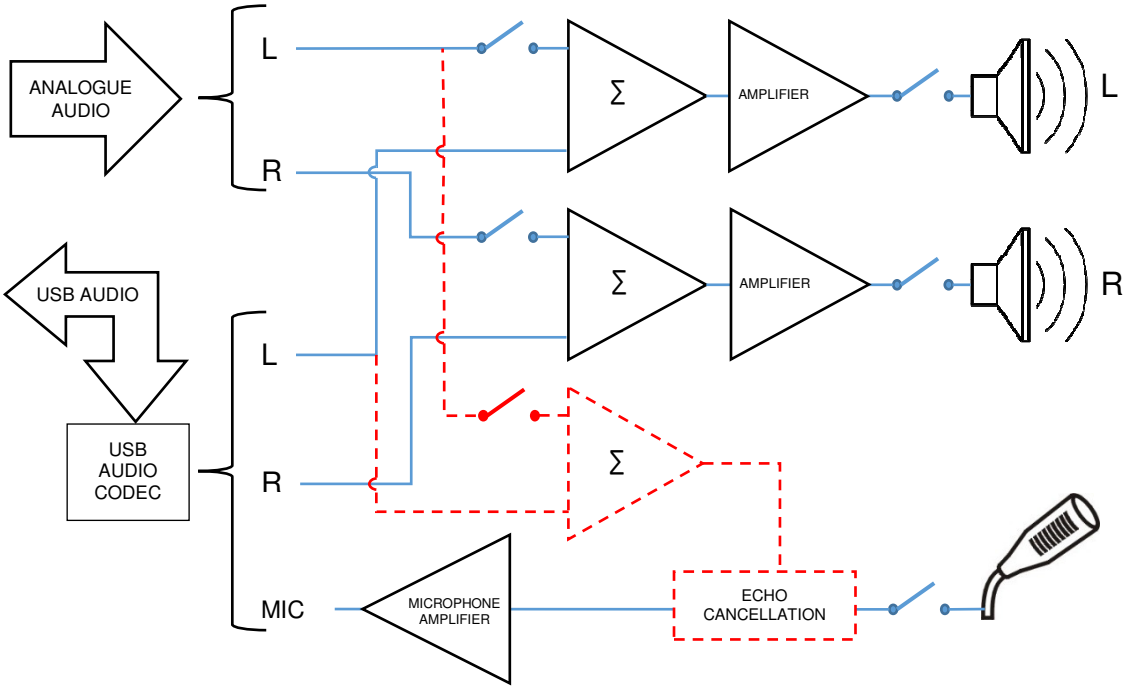


Figure A.4 Audio Board

- Hands-Free Amplifier. This is a linear audio amplifier with programmable gain that drives the Voice (Left) Speaker. Gain of this amplifier (i.e. volume of the Voice Speaker) can be adjusted by the user in normal operation via incremental encoder (i.e. endless digital potentiometer) at the rear right-hand side of the module. The selected level is immediately displayed at the bar-graph display in green colour (20 volume levels + mute). The amplifier can deliver up to 2 W (2 x 1 W) of electric power to the Voice Speaker.

- Alarm/Alert Amplifier. This is a linear audio amplifier with programmable gain that drives the Alert (Right) Speaker. Gain of this amplifier is equal to the gain of the Hands-Free Amplifier. It is capable of delivering up to 2 W (2 x 1 W) of electric power to the Alert Speaker.
- Bar-Graph Display. It comprises 10 three-colour (red, green and orange) LEDs to display level of the left output signal as VU meter (red colour), or gain of the Hands-Free amplifier (green colour). By default it constantly operates as VU meter. If a move of the incremental encoder has been detected it automatically displays gain of the Hands-Free Amplifier. If a press of brightness UP or DOWN key has been detected it automatically displays the current brightness setting of the display (orange colour).
- Incremental Encoder. This is an endless digital potentiometer used for immediate volume control of the Voice and Alert Speakers. It has 24 detents per revolution. Every single detent changes the volume for one step up or down, but only every second one is represented by one LED in the Bar-Graph display in green colour.

- The TFT LCD presents information provided by the mainboard via LVDS interface.
- The Touchscreen (sensor) provides the touchscreen controller with information about touch events. The touchscreen controller interprets this data and transfers results via USB to the mainboard.
- Mass Storage. The Solid State Disk is connected to the mainboard to read and write data.

A.5. Modularity

- combinable with other FREE/FREE+ add-on modules (e.g. handsets) into multifunctional terminals.
- built-in Tipro controller enables modularity and programmability.

A.6. Programmability

- built-in Tipro controller enables modularity and programmability via USB and RS232 interfaces
- brightness adjustment
- backlight on/off
- touchscreen disable/enable
- integrated buzzer for key-click and warning tones
- API available

B. TECHNICAL CHARACTERISTICS

B.1. General

ELECTRICAL

- **power supply**: 12V ± 5% (from an external AC/DC adapter)
- **power consumption**:

Operating Mode	Typical	Maximal
OFF (power saving)	0.2W	TBD
SLEEP (Windows standby)	3.0W	TBD
IDLE	21.0W	TBD
ACTIVE	25.0W	36.0W

Note 1:
Values in the table above are temporary approximations of typical consumption, obtained by measurements at the 12V power input of BeFREE 10 (LCD at full brightness) without any additional Tipro modules and without any other peripherals connected.

Note 2:
Terminology for Operating Modes is taken from "ENERGY STAR Program Requirements for Computers: Version 5.0".

MECHANICAL

- **casing**: plastic ABS, black (C15) colour with matte black (C25) top part
- **dimensions and weight**:

Size [W x D x H]	Weight
332 x 278 x 100 mm.	4.4 kg

- **protection (sealing) grade**: IP 20 (according to EN 60529)

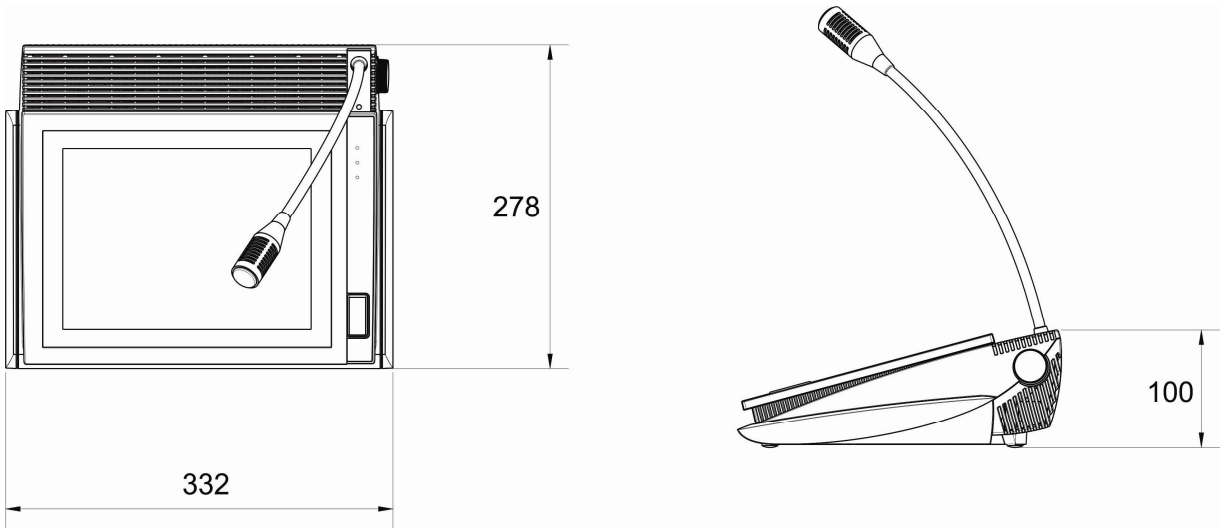


Figure B.1 Physical Dimensions

ENVIRONMENTAL

- **operating ambient temperature range**: +5°C to +35°C
- **storage ambient temperature range**: -10°C to 50°C
- **relative humidity range**: 20% to 80% (non-condensing)

B.2. TFT LCD

- **size**: 10.4" diagonal
- **aspect ratio**: 4:3
- **native resolution**: 1024 × 768 (XGA)
- **luminance/ brightness** (typical): ≥ 350 cd/m^2 (currently 350 cd/m^2)
- **contrast ratio** (typical): ≥ 400:1 (currently 1000:1)
- **backlight lifetime** (typical): ≥ 35,000 hours

B.3. Touchscreen

- **technology**: 5-wire resistive (ELO)
- **positional accuracy**: 2.03 mm (standard deviation of error)
- **positional accuracy**: ± 4.572 mm (maximum error)
- **touch activation force**: < 113 g (typically)
- **controller resolution**: 4096 x 4096 touch points
- **light transmission**: 80 ± 5 % (at 550 nm wavelength)
- **lifetime**: 35 x 10^6 touches in one location

B.4. Mainboard

The embedded mainboard used in BeFREE 10 utilizes the 3.5" form factor. The features listed are not necessarily all used, nor is this a complete list. Some technically less relevant features are omitted.

- **processor**
  - Intel© Atom D525 1.8 GHz 1MB L2 cache
- **chipset**
  - Northbridge functionality integrated in CPU
  - Southbridge 82801HBM (ICH8-M)
- **system memory**: 204-pin DDR3 SODIMM (800 MHz)
  - 4GB (Max)
- **video**
  - dual independent display support
  - chip: integrated in Intel® D525
  - memory: shared system memory up to 224MB/DVMT 4.0
  - resolution: up to 1920 x 1440
- **Ethernet**: Intel® 82567V & 82583V, 10/100/1000Base-TX
- **audio**
  - 2CH HD audio
- **I/O**
  - SATA II
  - RS-232
  - USB 2.0 ports
- **watchdog timer**: generates a timed-out system reset

B.5. Mass Storage

B.5.1. Solid State Disk

- **technology**: Multi-Level Cell (MLC) NAND
- **interface**: SATA II / 3 Gbps
- **form factor**: 2.5"
- **capacity**: ≥ 60 GB

B.6. Tipro Board/Controller

- full-speed USB 2.0 port (marked as USB 1.1), 100 mA
- ESD protected USB ports
- USB over-current protection
- Tipro BUS connectivity
- Tipro Power BUS connectivity
- two programmable digital inputs
- power management

B.7. Audio

- **Loudspeakers**
  - two in parallel within the left output
  - two in parallel within the right output
  - type: dynamic
  - rated power: 3 W
  - output sound pressure level (SPL): 84 dB ± 3 dB @ 1 W @ 1 kHz @ 0.5 m distance
- **Goose-neck Microphone**
  - type: electret condenser, unidirectional
  - max input: 120 dB SPL
- **Analogue amplifiers**
  - designed to meet narrow-band telephony standards
  - frequency pass-band: (200 Hz - 5 kHz) TYP
  - output power: 4 x 1 W (2 x 2 x 1 W)
- **USB Audio Codec**
  - model: Texas Instruments PCM 2902x
  - USB Interface: full-speed, USB 2.0 compliant, certified by USB-IF
  - resolution: 16-bit Delta-Sigma ADC and DAC
  - sampling rates (ADC): 8, 11.025, 16, 22.05, 32, 44.1, 48 kHz
  - sampling rates (DAC): 32, 44.1, 48 kHz

B.8. Power Supply

Power Supply Unit (AC/DC adapter) is normally supplied with the BeFREE 10, along with the EU power cord.

- **operating input voltage**: 100 VAC - 240 VAC, 50 - 60 Hz
- **output voltage/power**: 12V/ 80W
- **AC input connector**: IEC 60320 / C13 socket
- **power cord**: cord with CEE 7/x connector (protective ground is compulsory)

B.9. LED Indicators

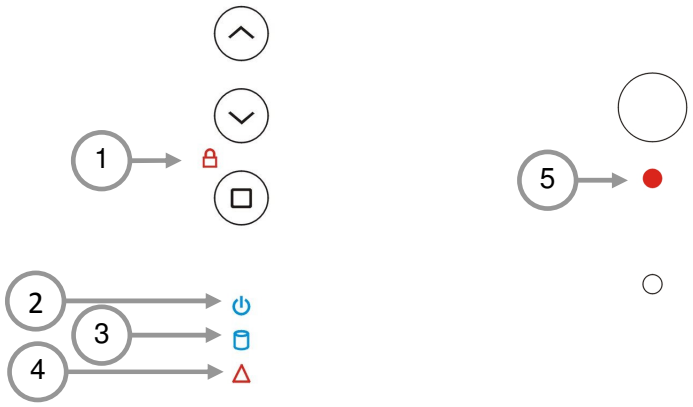


Figure B.2 LED Indicators

1	Touchscreen	On when touchscreen is disabled	Red
2	Power	• Short blink: OFF (power saving mode) • Long blink: SLEEP (standby) • Continuous: ACTIVE (operating)	Blue
3	Disk	Blinking indicates read/write activity of SSD	Blue
4	Warning	On when error occurred	Red
5	Microphone	On when microphone is active (enabled)	Red

Table B.1 LED indicators

B.10. Mechanical Keys

- **Push To Talk Key**
  - model: Cherry MX
  - key travel: 3.6 mm to 4.0 mm total, (2 ± 0.6) mm pretravel
  - actuating force: (60 ± 20) cN
  - reliability (Mean Cycles To Failure): MCTF = 1 billion (10^9) press/release cycles (50 million is guaranteed minimum)
- **Control Keys**
  - model: Diptronic DTS
  - key travel (typical): 0.3 mm
  - actuating force (typical): 255 cN
  - lifetime (minimal): 0.5 million operations

C. CONNECTIVITY

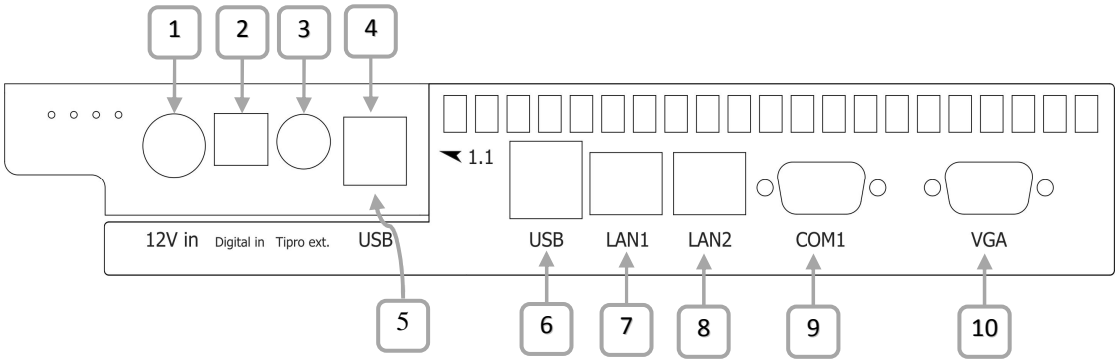


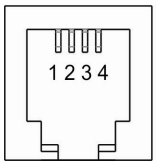
Figure C.1 Connector Plate

#	Designator	Type	Note
1	12V Input	Mini Power DIN	
2	Digital Input	RJ 4P/4C	See details below
3	Tipro External Bus	Mini DIN 5	
4	USB	USB type – A	Full-Speed, 100 mA
5	USB	USB type – A	High-Speed, 500 mA
6	Dual USB	2 × USB type – A	High-Speed, 500 mA
7	LAN 1	RJ 8P/8C (RJ 45)	
8	LAN 2	RJ 8P/8C (RJ 45)	
9	COM 1	DSUB-9 male	
10	VGA	DSUB-15 female	

Table C.1 Connectors

C.1. Connectors

Below are pin/signal descriptions of the connectors that are specific to BeFREE 10. All standard connectors (USB, RS232, VGA, etc.) can be found in the BeFREE User's Manual.



Pin #	Signal
1	A -
2	A +
3	B +
4	B -

Figure C.2 Digital Inputs Connector

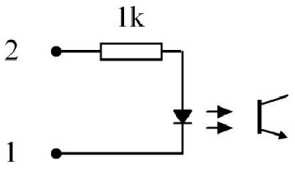
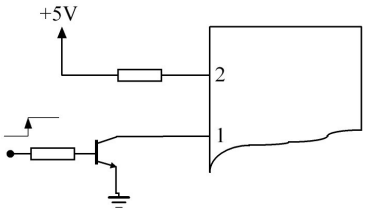
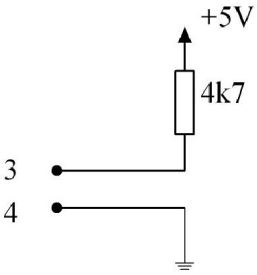
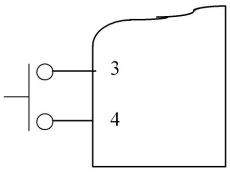
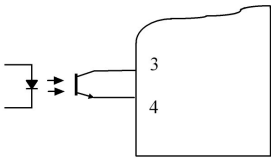
Port	Internal circuitry	Suggested external circuitry
A		
B		 

Figure C.3 Applying Digital Inputs

D. CONFIGURING BeFREE 10

D.1. Programming

The BeFREE 10 has a Tipro Controller integrated in. ChangeMe application software shall be used to (re)define parameters/settings of the BeFREE 10 and connected Tipro modules.

D.1.1. ChangeMe

Several settings of the BeFREE 10 can be modified with ChangeMe:

- Backlight control. The backlight of the display can be adjusted with ChangeMe, e.g. for use in dark environments.
- Touchscreen disable/enable. The touchscreen can be disabled for a certain period of time, e.g. for cleaning purpose.
- Energy saving. Different power options of the whole configuration/terminal can be set.
- PTT and Control Keys. Definition of key codes to be sent upon press/release

D.1.2. API

To modify options and settings from another software application, the Tipro API can be used. Specific functions for BeFREE 10 include:

- Power options of BeFREE 10 (enable standby, wake on LAN)
- Touchscreen disable and enable
- LCD brightness adjustments
- Various audio controls

E. OPTIONS

E.1. Inclinanation Mechanism

BeFREE 10 can be fitted with an Inclination Mechanism (also referred to as Angle Adjustment Mechanism). Normally, the display surface of BeFREE 10 is inclined for 15^0 against the horizontal plane. The mechanism enables adjustment of the angle from approximately 30^0 to 70^0 in more than 10 steps.

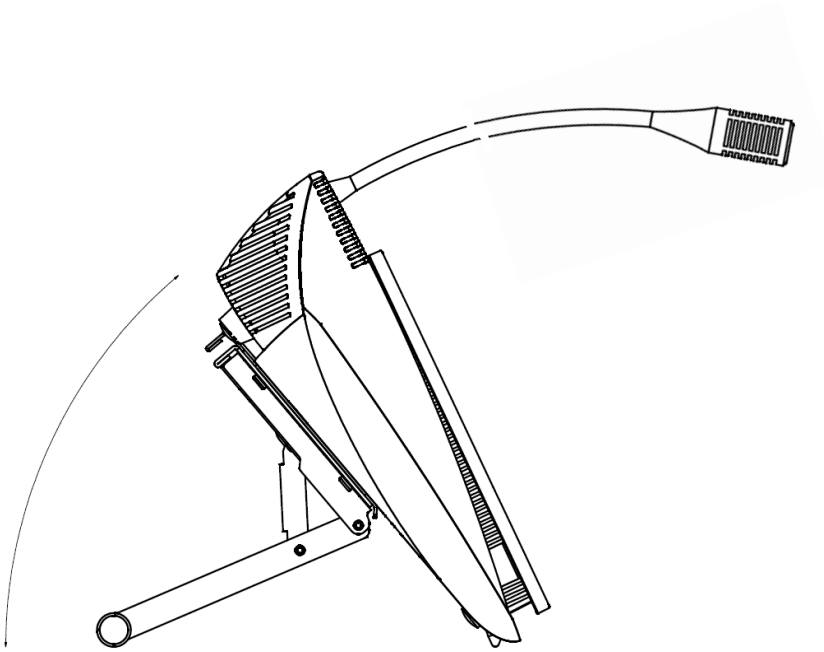


Figure E.1 BeFREE 10 with Inclination Mechanism

E.2. VESA Mounting

BeFREE 10 is equipped with mounting holes/nuts as per VESA 75 standard.

E.3. Echo-Cancellation Circuitry

Acoustic echo is a physical phenomenon inherent to hands-free devices (such as InterCom), so it needs to be suppressed and/or cancelled. This is normally implemented in the application software through the specific signal processing routines. Alternatively, it can be achieved in the hardware using a digital signal processor. Basic properties of the

optional (see Chapter F.1 for details on the respective Ordering Code) Echo-Cancellation circuitry are listed below.

- **performance**: full-duplex
- **sampling rate**: 16 kHz
- **acoustic echo-cancellation**: ≥ 40 dB
- **latency**: ≤ 50 ms

E.4. Goose-Neck Microphone

By default, the goose-neck microphone is an integral part of the BeFREE 10, but it can be optionally omitted. See Chapter F.1 for details on the respective Ordering Code.

F. ORDERING CODES

F.1. BeFREE 10

1	2	3	4	5	6	7	8	9
BF	**10**	**-**	**G**	**D2**	**-**	**R U 0**	**-**	**C15C25**	**-**	**xxx**

1 – Module Type

BF – **BeF**REE (touchcomputer) module

2 – Display Size

10 : **10**.4”

3 – Computer

G : Intel Atom D525 @ 1.8 GHz with 4 GB RAM

4 – Version & Connectivity

D2 : Fanless version with audio features (“**D**ispatcher”)

5 – Touchscreen Technology

R : ELO **R**esistive (zero-bezel)

6 – Integrated Audio Options

U : **U**SB Speakerbox functionality
C : USB Speakerbox functionality with Echo-**C**ancellation Circuitry
V : USB Speakerbox functionality without goose-neck microphone

7 – Reserved

0 : none

8 – Housing Colour

C15C25 : black (C15) with black matte (C25) top part of the housing

9 – Custom Version

Three-digit number reserved for product customizations. It is omitted in case of standard version.

F.2. Inclination Mechanism

1 2 3 4 5

TM - S U A - C15 - xxx

1 – Accessory Type

S – Mechanical **S**upport mechanism (Inclination Mechanism)

2 – Mechanism Type

U : **U**niversal

3 – Adapter Type

A : BeFREE 10

4 – Colour

C15 : black

5 – Custom Version

Three-digit number reserved for product customizations. It is omitted in case of standard version.

G. REFERENCES

1. "BeFREE 10" – User's Manual

2. "ChangeMe" – User's Manual

H. NOTICES

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