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# **ARMPAC-6XX** Series

7", 8", 10.1", and 12.1" Fanless i.MX6 DualLite ARM Cortex A9 HMI Series

## **User Manual**

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## **Revision History**

Reversion	Date	Description	
1.0	2016/11/08	Official Version	
1.1	2017/01/13	Add SOP of updating Firmware and Linux QT, and	
		update power consumption and net weight. Update	
		SBC-7112 motherboard manual to R1.2 version	
1.2	2017/04/12	Modify power consumption data.	
1.3	2017/07/19	Remove 5"	
		Add 15", 15.6"	
1.4	2017/10/20	Add motherboard version	
		Modify software/IP rating	
		Delete 15", 15.6"	
1.5	2018/11/08	Delete all QTs data	
		Update OS Support list	
1.6	2019/03/18	Update Storage Temperature	
1.7	2019/10/18	Modify Linux and ANDROID information and photos	

## Warning!

This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Electric Shock Hazard – Do not operate the machine with its back cover removed. There are dangerous high voltages inside.

#### Caution

Risk of explosion if the battery is replaced with an incorrect type. Batteries should be recycled where possible. Disposal of used batteries must be in accordance with local environmental regulations.

#### Disclaimer

This information in this document is subject to change without notice. In no event shall Aplex Technology Inc. be liable for damages of any kind, whether incidental or consequential, arising from either the use or misuse of information in this document or in any related materials.

## Packing List

Accessories (as ticked) included in this package are:			
Adaptor			
Driver & manual CD disc			
☐ Other	_(please specify)		

### **Safety Precautions**

Follow the messages below to prevent your systems from damage:

- Avoid your system from static electricity on all occasions.
- Prevent electric shock. Don't touch any components of this card when the card is power-on. Always disconnect power when the system is not in use.
- Disconnect power when you change any hardware devices. For instance, when you connect a jumper or install any cards, a surge of power may damage the electronic components or the whole system.

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## Chapter 1

## **Getting Started**

### **1.1 Features**

- ARM based HMI
- Fanless design
- Flat front panel touch screen
- Freescale i.MX6 DualLite/Quad (option) ARM Cortex A9 Processor
- Onboard 1GB DDR3 DRAM
- Onboard 4GB eMMC Flash
- Wide range DC 9~36V power input
- LED backlight LCD
- Resistive touch windows/Projected capacitive touch

### **1.2 Specifications**

	ARMPAC-607(P)	ARMPAC-608(P)	ARMPAC-610(P)	ARMPAC-612(P)
System				
CPU	Freescale i.M	K6 DualLite/Quad(option	on) ARM Cortex A9 pro	cessor 1.0GHz
Memory		Onboard 1GE	B DDR3 DRAM	
External IO Port				
USB		2 x USB 2	2.0 type A	
		1 x USB 2.0 (	Micro B type)	
Serial/Parallel		1 x RS-232/422/	485 DB-9, COM1	
LAN		1 x LA	N Port	
Power	1 x 9	1 x 9~36V DC power input via 1 x 3-pin terminal block		
Option	1 x RS-232/422/485 (TB-508C1)			
	WIFI/4G module via Mini-PCIe			
Internal IO Port				
Internal IO Port	1 x SIM card slot			
	1 x Micro SD slot			
Storage Space				
Storage	Onboard 4GB eMMC NAND flash			
Expansion				
Expansion Slot	1 x Mini-PCIe Slot full size			
Display				
Display Type	7" color TFT LCD	8" color TFT LCD	10.1" color TFT LCD	12.1" color TFT LCD

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Resolution	800x480	800x600	1024x600	800x600
Max. Color	262K	262K 262K		262K
Luminance	350	350	250	450
Contrast Ratio	400: 1	500: 1	500: 1	800: 1
Viewing Angle	140(H)/110(V)	140(H)/135(V)	140(H)/120(V)	160(H)/140(V)
Backlight Lifetime	40,000 hrs	40,000 hrs	25,000 hrs	50,000 hrs
Touch Screen – Resis	tive Touch Window Ty	ре		
Interface		S	PI	
Light Transmission		Over	80%	
Touch Screen – Proje	cted Capacitive Type			
Interface		U	SB	
Light Transmission		Over	90%	
Power				
Power Input		DC9 <sup>,</sup>	~36V	
Power	MAX: 5.3W	MAX: 7W	MAX: 7W	MAX: 10.8W
Consumption	(607)	(608)	(610)	(612)
Mechanical				
Front Bezel Metal	Plastic/Panel Mount			
Rear Panel Metal	Plastic/VESA 75 Plastic/VESA 100			
Chassis Color		Pantone Co	ol Gray 11C	
IP Rating		IP66 Fro	ont Panel	
Dimensions	204 x 150 x 42.5	231.1 x 176.1 x 45	285 x 189 x 49.6	319 x 245 x
	mm	mm	mm	51 mm
Net Weight	0.9 Kg	0.9 kg	1.4 Kg	1.5 Kg
Environmental				
Operating	<b>0~50</b> ℃			
Temperature				
Storage	-30~70°C			
Temperature				
Storage Humidity	10 to 90% @ 40 $^\circ\!\mathrm{C}$ , non-condensing			
Certification	CE / FCC Class A			
<b>Operating System</b>	Linux 4.9.88+ChromiumV67 ; ANDROID 6.0.1			

### **1.3 Dimensions**





Figure 1.2: Dimensions of ARMPAC-608(P)







Figure 1.4: Dimensions of ARMPAC-612(P)

### **1.4 Brief Description of ARMPAC-6XX**

There are 7", 8", 10.1", and 12.1" in fanless designed ARM based HMI, which comes with flat front panel LED backlight touch designed. It is powered by Freescele i.MX6 DualLite/Quad (option) ARM Cortex A9 processor, 1GB DDR3 onboard memory, and 4GB eMMC NAND flash onboard. ARMPAC-6XX series is DC 9~36V wide range power input and IP66 compliant front panel. The 7", and 8" model can be VESA 75 x 75 mounted, and 10.1", 12.1" can be VESA 100 x 100 mounted. The chassis color are pantone cool gray 11C for plastic design in 7", 8", 10.1", and 12.1". Optional projected capacitive touch screen supports 7H anti-scratch surface is ideal for use as PC-based controller for industrial automation & factory automation.



Figure 1.7: Front View of ARMPAC-6XX Series



Figure 1.8: Rear View of ARMPAC-6XX Series

### **1.5 VESA Mounting**

The ARMPAC-6XX series is designed to be VESA mounted as shown in Picture. Just carefully place the unit through the hole and tighten the given screws from the rear to secure the mounting.



Figure 1.9: ARMPAC-6XX Series VESA Mounting

### **1.6 Panel Mounting**

There are four holes located along the four sides of the HMI. Insert the clamp from the four sides and tighten them with the nuts provided.



Figure 1.10: ARMPAC-6XX Series Panel Mounting

## 2.1 Motherboard Jumpers Setting and Connectors

#### 1. J5:

(Micro USB OTG 5P Connector), it is used to download and connect to Android App.

#### 2. USB1:

(Double stack USB type A), Front USB connector, it provides 2 USB2.0 ports, High-speed USB 2.0 allows data transfers up to 480 Mb/s, support USB full-speed and low-speed signaling.

#### 3. LAN1:

(RJ45 Connector), Front LAN port. One standard 10/100M RJ45 Ethernet port is provided. Used Atheros AR8031 chipset, support LINK LED (green) and ACTIVE LED (yellow).

#### 4. MIO1:

(1.25mm Pitch 2\*15 Connector), Including eight General-purpose input/output  $\sim$  a group of SMBUS and two groups of serial communication interfaces, it provides a group of self-programming interfaces to customers for flexible use.

Signal Name	Pin#	Pin#	Signal Name
PWRON	1	2	GND
POR_B	3	4	GND
5V_S0	5	6	GND
GPIO_IN0	7	8	GPIO_IN1
GPIO_IN2	9	10	GPIO_IN3
GPIO_OUT0	11	12	GPIO_OUT1
GPIO_OUT2	13	14	GPIO_OUT3
I2C3_SCL	15	16	5V_S0
I2C3_SDA	17	18	NC
GND	19	20	NC
UART1_TXD_B	21	22	GND
UART1_RXD_B	23	24	UART2_TXD
NC	25	26	NC
NC	27	28	UART2_RXD
GND	29	30	NC

#### 5. COM1

(Type DB9), Front serial port, standard DB9 Male serial port is provided to make a direct connection to serial devices. Used the SP339E as the driver, which is an advanced multiprotocol transceiver supporting RS-232, RS-485 and RS-422.

	4 4
Pin#	Signal Name
1	DCD3422TX485-
2	RXD3_422TX+_485+
3	TXD3_422RX+
4	DTR3_422RX-
5	GND
6	NC
7	NC
8	NC
9	COM3_9PIN(connect to JP1)



#### 6. CON2:

(2.0mm Pitch 2\*8 Pin Socket), it provides a group USB2.0 SMBUS UART and CANBUS interfaces.

Signal Name	Pin#	Pin#	Signal Name
5V_S0	1	2	NC
USBDN_CON2_DM3	3	4	UART4_TXD
USBDN_CON2_DP3	5	6	UART4_RXD
GND	7	8	GND
GND	9	10	CAN1_TX
I2C2_SDA	11	12	CAN1_RX
I2C2_SCL	13	14	NC
3P3V_S0	15	16	NC

#### 7.CON1:

(TF Card Socket), Support TF Card devices.

#### 8. TOUCH1:

(2.00mm Pitch 2\*5 Pin Header), Used the AR1021 as the touch screen controller which supports resistive touch screen. ARMPAC-6XX Series User Manual

Signal Name	Pin#	Pin#	Signal Name
Y-	1	2	SY-
SY+	3	4	Y+
Х-	5	6	5WSX-
SX+	7	8	X+
M2(U17)	9	10	GND

#### 9. SIM1:

(SIM Card Socket), Support SIM Card devices.

#### 10. LVDS1:

(1.25mm Pitch 2\*10 Connector, DF13-20DP-1.25V), For 18-bit LVDS1 output connector.

Signal Name	Pin#	Pin#	Signal Name
VCC_LVDS0	1	2	VCC_LVDS0
GND	3	4	GND
LVDS0_TX0_N	5	6	LVDS0_TX0_P
LVDS0_TX1_N	7	8	LVDS0_TX1_P
LVDS0_TX2_N	9	10	LVDS0_TX2_P
NC	11	12	NC
LVDS0_CLK_N	13	14	LVDS0_CLK_P
GND	15	16	NC
BKLT_CTRL0	17	18	BKLT_EN_OUT0
VCC_BL0	19	20	VCC_BL0

#### 11. LVDS2:

(1.25mm Pitch 2\*10 Connector, DF13-20DP-1.25V), For 18/24-bit LVDS1 output connector.

Signal Name	Pin#	Pin#	Signal Name
VCC_LVDS1	1	2	VCC_LVDS1
GND	3	4	GND
LVDS1_TX0_N	5	6	LVDS1_TX0_P
LVDS1_TX1_N	7	8	LVDS1_TX1_P
LVDS1_TX2_N	9	10	LVDS1_TX2_P
LVDS1_TX3_N	11	12	LVDS1_TX3_P
LVDS1_CLK_N	13	14	LVDS1_CLK_P

GND	15	16	NC
BKLT_CTRL1	17	18	BKLT_EN_OUT1
VCC_BL1	19	20	VCC_BL1

#### 12. INVT1:

(2.0mm Pitch 1\*6 box Pin Header), Backlight control connector for LVDS1.



Pin#	Signal Name
1	VCC_BL0
2	VCC_BL0
3	GND
4	GND
5	BKLT_EN_OUTO
6	BKLT_CTRL0

#### 13. BT1:

(1.0mm Pitch 1\*2 box Pin Header), 3.0V Li battery is embedded to provide power for RTC.

Pin#	Signal Name
1	VRTC
2	GND

#### 14. INVT2:

(2.0mm Pitch 1\*6 box Pin Header), Backlight control connector for LVDS2.

- N M 4 4 9 9		
Pin#	Signal Name	
1	VCC_BL1	
2	VCC_BL1	
3	GND	
4	GND	
5	BKLT_EN_OUT1	
6	BKLT_CTRL1	

#### 15. J20:

(1.0mm Pitch 1\*2 box Pin Header), Reserved to connect switch reset button..

#### 16. MPCIE1:

(Mini PCIe Socket 52Pin), mini PCIe socket, it is located at the top, it supports mini PCIe devices with USB2.0 and SIM and SMBUS and PCIe signal. MPCIe card size is 30\*30mm or 30\*50.95mm.

#### 17. JP1:

(2.0mm Pitch 2\*3 Pin Header), COM1 jumper setting, pin1~6 are used to select signal out of pin 9 of COM1 port.

JP1 Pin#	Function
Close 1-2	COM1 Pin9 = NC (option)
Close 3-4	COM1 Pin9 = +5V (default)
Close 5-6	COM1 Pin9 = +12V (option)

#### 18. J1:

(2.0mm Pitch 1\*3 Pin Header), LVDS1 jumper setting. It is used to provide 3.3V or 5V voltage to VCC\_LVDS0.

J1 Pin#	Function
Close 1-2	VCC_LVDS0 = 3.3V (option)
Close 2-3	VCC_LVDS0 = 5V (default)

#### 19. J2:

(2.0mm Pitch 1\*3 Pin Header), LVDS1 jumper setting. It is used to provide 5V or 12V voltage to VCC\_BL0.

J2 Pin#	Function
Close 1-2	VCC_ BL0 = 5V (option)
Close 2-3	VCC_ BL0 = 12V (default)

#### 20. J3:

(2.0mm Pitch 1\*3 Pin Header), LVDS2 jumper setting. It is used to provide 3.3V or 5V voltage to VCC\_LVDS1.

J3 Pin#	Function
Close 1-2	VCC_LVDS1 = 3.3V (option)
Close 2-3	VCC_LVDS1 = 5V (default)

#### 21. J4:

(2.0mm Pitch 1\*3 Pin Header), LVDS2 jumper setting. It is used to provide 5V or 12V voltage to VCC\_BL1.

J4 Pin#	Function
Close 1-2	VCC_BL1 = 5V (option)
Close 2-3	VCC_ BL1 = 12V (default)

#### 22. SW2:

Dial Switch , it is used to select the voltage for BKLT\_CTRLO and BKLT\_EN\_OUTO.

SW2 Pin#	Function	Function
1-4	Close	Open(default)
	BKLT_CTRL0 = 3.3V	BKLT_CTRL0 = 5V
2-3	Close	Open(default)
	BKLT_EN_OUT0 = 3.3V	BKLT_EN_OUT0 = 5V

#### 23. SW3:

Dial Switch, it is used to select the voltage for BKLT\_CTRL1 and BKLT\_EN\_OUT1.

SW3 Pin#	Function	Function
1-4	Close	Open(default)
	BKLT_CTRL0 = 3.3V	BKLT_CTRL0 = 5V
2-3	Close	Open(default)
	BKLT_EN_OUT0 = 3.3V	BKLT_EN_OUT0 = 5V

## Chapter 3

## **3.1** Update Linux for SBC-7112

1. Close Chromium Browser and return to desktop, then select the "Terminal" APP.





2. Key-in below command to erase the EMMC data (change to Download Mode).



3. Connect Micro USB Cable from SBC-7112 to your desktop/laptop and run update tool "Linux 4.9.88-eMMC-MX6DL-ALL.vbs".





4. It will show up "Hub X--Port Y" on the upper left side if USB cable has been connected well, and then click "Start" to update Linux Firmware

MfgTool_MultiPanel (Library: 2.6.2)		×
Hub 6Port 2	Status Information	
Drive(s):	Successful Operations:	0
	Failed Operations:	0
HID-compliant vendor-defined device	Failure Rate:	0 %
	Start	Exit
Hub 6Port 2		×
Drive(s); E:	Successful Operations:	0
	Failed Operations:	0
Sending and writting rootfs	Esiluro Dato:	0
	i dilui e Nate,	0%
	Stop	0 % Exit

5. When you finish updating, the screen will show the increasing counting numbers of "Successful Operations". Click "Stop" and "Exit" then reset machine.

HgTool_MultiPanel (Library: 2.6.2)	-	×
Hub 6Port 2	Status Information	
Drive(s): E:	Successful Operations:	1
	Failed Operations:	0
Done	Failure Rate:	0.00 %
	Stop	Exit

6. Linux 4.9.88+Chromium Browser have been updated successfully!!



## 3.2 Update Android Firmware

To update Android firmware, there must be three files as shown below.

Organize 🔻 Include ir	n library 🔹 Share with 💌	New folder		8≕ ▼ 🗂 (
Computer Computer Cocal Disk (C:) Android Android ParfLogs PerfLogs Program Files	Name EraseMMC Iatest_usb_driver_windows MfgToolA601-master	Date modified 10/20/2017 1:54 PM 11/1/2016 1:16 PM 10/17/2019 10:11 AM	Size 2,912 KB 8,471 KB 271,512 KB	Type Compressed (zipped) F Compressed (zipped) F Compressed (zipped) F
👂 🍌 Users 🖉 🗸	•			Ţ.

- 1. File1: latest\_usb\_driver\_windows.zip (ADB Interface Driver for Windows 7) The USB driver should be connected to VITAM-6XX device
- 2. File2: EraseMMC.zip

Erase all data on Flash and switch to download mode before updating Android firmware.

3. File3: MfgtoolA601\_master.zip

Update Android Firmware & update utility

### Step 1. → File1: latest\_usb\_driver\_windows.zip (ADB Interface Driver for Windows

7)

1) Install ADB Interface Driver for Windows 7. (laster\_usb\_driver\_windows.zip).



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2) Double click "ADB Interface" to "Update Driver".



3) Select "Browse my computer for driver software" to locate and install driver software.



4) Click "Browse" to \lastest\_usb\_driver\_windows\usb\_driver\.





5) Click "Close" to complete the driver installation.



PS: Windows 10 OS Please skip step 1.



#### Step 2. → File2: EraseMMC.zip

1) Switch to Download mode (Erase all data on Flash) via "EraseMMC.bat".



2) It switches to Download Mode when the screen shows like the picture below, and then you can reset the machine ARMPAC-6XX.



• There will be error message as shown like below picture if the USB hasn't been connected well.



#### Step 3. → File3: MfgToolA601-master.zip

1) Copy all images files include boot-imx6dl.img & recovery-imx6dl.img &

system.img & u-boot-imx6dl.imx into "sabresd" folder as below.

\MfgToolA601-master\Profiles\Linux\OS Firmware\files\android\sabresd

Organize 👻 Include in library 👻	Share with 🔻 New folder	ti -		
	* Name	Date modified	Туре	Size
Version of the second s	🕑 boot-imx6dl	7/8/2019 12:05 PM	Disc Image File	9,408 KB
Local Disk (C:)	🙆 recovery-imx6dl	7/8/2019 12:05 PM	Disc Image File	10,140 KB
Android	🚽 🙆 system	7/8/2019 12:32 PM	Disc Image File	472,920 KB
<ul> <li>Iatest_usb_driver_windows</li> <li>MfqToolA601-master</li> <li>Profiles</li> <li>Linux</li> <li>OS Firmware</li> <li>files</li> <li>android</li> <li>evk</li> <li>sabreauto</li> </ul>	U-boot-imx6dl.imx	7/8/2019 12:06 PM	IMX File	503 KB
Jabresd Jack				
🍌 firmware	*			

2) Run "Android6.0.1-eMMC-MX6DL-ALL.vbs" to update firmware utility. The screen will show "HUB X-Port X" if the USB has been connected well. Then click "Start" to update firmware.

Organize *	Den + P	rint New folde	1			1 · = :	C.	0
🏭 Local Disk (	C:)	* Name	· ·	Date modified	Type	Size		
Android		Profiles		10/22/2017 10:56	File folder			
EraseM	MC	Android	1.2.2-eMMC-MX6DL-ALL	10/12/2017 4:48 AM	VBScript Script File	1.88		
latest_u	sb_driver_windows	Android	5.1.1-eMMC-M0/6DL-ALL	10/12/2017 4:48 AM	VBScript Script File	1 KB		
Migloc	nAbu1-master	Andreid	5.0.1-eMMC-MX5DL-ALL	10/12/2017 4-48 AM	VBScript Script Elle	1 KB		
Perfl our		e dg		10/12/2017 4:48 AM	Configuration sett	1 83		
Pionram	Filet	MfgTool		10/17/2019 3:25 PM	Text Document	0 KB		
Program	Files (x86)	MfgToci	2	10/12/2017 4:48 AM	Application	1,950 KB		
Users	Contra Present	E MfgTool	Lib.dll	10/12/2017 4:48 AM	Application extens	2,190 KB		
Windows		README	md	10/12/2017 4:48 AM	MD File	3 KB		
8		(@) UICfg		10/12/2017 4:48 AM	Configuration sett	1 KB		
🙀 Network	MigTool Mu	ItiPanel (Library: 2.6	5.2)					
Andro V85cm	Hub 2-Port 2 Drive(s): HD-compliant d	evice.	Status Information Successful Operati Failed Operations: Pailure Rate:	ons: 0 10 0 %	)/13/2017 1:36 AM			

• The screen will show like this picture if the USB has not been connected well.

Status Information	
Successful Operations:	C
Failed Operations:	C
Failure Rate:	0 %
	Evit
	Status Information Successful Operations: Failed Operations: Failure Rate:

3) The screen will show the increasing counting numbers of "Successful Operations" when firmware has been updated successfully.

ganae - e open - enne	New folder			(E) *	
🐔 Local Disk (Ci) 🔄	Name	Date modified	Type	Size	
Android	Profiles	18/22/2017 10:56	File folder		
FraseMMC	Android4.2.2-eMMC-MX60L-ALL	10/12/2017 4-48 AM	VBScript Script File	1.88	
Intest_usb_driver_windows	Android51.1-eMMC-M06DL-ALL	10/12/2017 4:48 AA#	VBScript Script File	1.108	
MfgToolAb01-master	Android5.0.1-eMMC-MX6DL-ALL	10/12/2017 4:48 AM	VRScript Script File	1.008	
Dud and	a dg	10/12/2017 4:48 AM	Configuration sett	11/8	
PenLogs	MigTael	10/17/2019 3:35 PM	Text Document	0 KB	
Orgenmer Film (196)	MigTool2	10/12/2017 4:48 AM	Application	1,990 KB	
Instr	MfgToolLib.dll	10/12/2017 4:48 AM	Application extent	2,190 83	
Windows	README.md	10/12/2017 4:48 AM	MD File	3.8H	
Removable Disk (Dt)	UICfg	10/12/2017 4:48 AM	Configuration selt	1.03	
A Migt	ool_MultiPanel (Library: 2.6.2)	-	×		
Hub 2-4	ort 2 Status	Information			
Android6.0.1-eM Uptout Court El Drive(s):	Di Succes	sful Operations:	0 1136 AM		
Contraction of the second second	Paled	Operations:	0		
	2 Toto District O	West Sec.	A 84 1		 

irganize 👻 👩 Open 👻 Prir	nt New folder		8==	• 💷
Local Disk (C:)	Name	Date modified	Туре	Size
Android	Profiles	10/22/2017 10:56	File folder	
EraseMMC	Android4.2.2-eMMC-MX6DL-ALL	10/12/2017 4:48 AM	VBScript Script File	1 KB
latest_usb_driver_windows	Android5.1.1-eMMC-MX6DL-ALL	10/12/2017 4:48 AM	VBScript Script File	1 KB
Mfg1oolA601-master	Android6.0.1-eMMC-MX6DL-ALL	10/12/2017 4:48 AM	VBScript Script File	1 KB
Jintel -	👔 cfg	10/12/2017 4:48 AM	Configuration sett	1 KB
PerfLogs	MfgTool	10/17/2019 3:35 PM	Text Document	0 KB
Program Files	MfgTool2	10/12/2017 4:48 AM	Application	1,950 KB
Program Files (x86)	MfgToolLib.dll	10/12/2017 4:48 AM	Application extens	2,190 KB
Users	README.md	10/12/2017 4:48 AM	MD File	3 KB
Barraushla Disk (Dr)	🖉 UICfg	10/12/2017 4:48 AM	Configuration sett	1 KB
- Kentovable Disk (D:)	MfgTool MultiPapel (Library: 2.6.2)		. <u> </u>	
Network	ub 2-Port 2 St	atus Information		
Android6.0.1-eMMC- Dri	ve(s): D: 🖒 🖒	uccessful Operations:	1 SAM	
VBScript Script File	Fa	ailed Operations:	0	
<u> </u>	ione Fa	ailure Rate:	0.00 %	