



E Ink ArC30™ Controller User's Manual

Version REV-

E Ink P/N 960-1430

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U.S.A.

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E Ink ArC30™ Controller

USER'S MANUAL

VERSION REV-

29 August 2018

IMPORTANT NOTE: Read this manual **BEFORE** installing the E Ink ArC30™ Controller or powering it up. The controller will require programming and configuration prior to use.

The E Ink ArC30™ Controller is shipped with a default animation file and set to “slave” mode. See Section 5 of this manual for further information.

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20. Support

For support issues or questions regarding your ArC30™ controller, E Ink’s Prism™ color-changing material, or other aspects of your installation, please e-mail E Ink at

prism-support@eink.com

You can also obtain information regarding the Prism product line of materials and controllers for architectural and design applications by visiting our website at:

<http://www.eink.com/prism/>

1. Introduction and Overview

Thank you for your purchase of an E Ink ArC30™ Controller. This product provides programmable, standalone drive for over 80 square meters (860 ft²) and up to 128 separate tiles or segments of E Ink's Prism™ color-changing material for use in architectural and interior design applications. For larger, more complex installations, multiple controllers may be connected in a master/slave configuration such that control of the entire system may be coordinated. Multiple patterns of color changes and animations may be stored within each controller, and the addition of optional Micro-SD flash storage permits a virtually unlimited number of different animation programs, permitting designers to set up a wide range of complex effects and sequences of color-change patterns.

Physically, the controller is a compact unit that can be wall-mounted, used within a permanent enclosure, or set up as-is in a temporary installation. The entire system can be powered by a small external power supply or battery pack, and all components and cabling use low voltage drive for enhanced safety.

Please take the time to read this manual thoroughly and note all warnings, cautions, and operational guidelines prior to the installation and operation of this controller. Failure to heed these warnings, cautions, and guidelines can result in improper operation, product damage or failure, or an unsafe operating condition.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radiation Exposure Statement

The device has been found to be compliant to the requirements set forth in CFR 47 Sections 2.1091 and Industry Canada RSS-102 for an uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Le dispositif a été jugé conforme aux exigences énoncées dans les articles 47 CFR 2.1091 et Industrie Canada RSS-102 pour un environnement non contrôlé. L'antenne(s) utilisée pour ce transmetteur doit être installée pour fournir une distance de séparation d'au moins 20 cm de toutes les personnes et ne doit pas être co-localisée ou fonctionner en conjonction avec une autre antenne ou transmetteur.

EU RoHS Compliance: To the best of E Ink's knowledge and based upon information received from our suppliers, this product meets the requirements of the Commission Delegated Directive 2015/863 of 31 March 2015 amending Annex II to Directive 2011/65/EU.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device complies with Part 15 of the FCC Rules:

Operation is subject to the following conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation

Changes and Modifications not expressly approved by E Ink Corporation can void your authority to operate this equipment under Federal Communications Commission rules.

IMPORTANT

These instructions do not purport to cover all details or variations in equipment, nor to provide for every contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise that are not covered sufficiently for your, the user's, purposes, please contact E Ink Support. (See Section 20 of this User's Manual).

2. Warnings and Notices

Please review the following warnings and notices prior to the use of this product. The following symbols will be used throughout this manual to highlight important notes regarding the correct and safe use of this product:

 Indicates an important note or item required for the proper installation or operation of the system. Failure to install and operate the product as directed by these notes may result in product failure or affect the reliability or operational lifetime of these products.

 This symbol indicates important information relating to the safe installation or operation of your system, or describes factors which may result in product failure, unsafe conditions, or affect the reliability or operational lifetime of these products.

This product is to be used only with E Ink Prism™ material as provided by E Ink and its authorized resellers in installations and operating as described in this manual and other documentation as provided on E Ink's website. Use of the product in any other manner voids any and all warranties and E Ink Corporation assumes no liability for damage, failure, or injury to this or any other product, device, property, or person resulting from such use.

RESTRICTIONS:

 **WARNING:** This product is intended for indoor use only. Do not use outdoors or where the unit might be exposed to water, excessive heat, or open flames.

This product is intended for use in commercial environments, is not meant for use in residential areas.

19. Warranty, Disclaimers, and Regulatory Statements

WARRANTY: This product carries a limited warranty for one year from the date of shipment. Please see the complete warranty terms at www.eink.com.

 Do not open the controller. There are no user-serviceable parts inside the controller case. Opening the controller case will void the warranty and may result in the controller being unsafe to operate.

 This product is for indoor use only. Do not install or attempt to operate this product in locations where it will be exposed to precipitation, extreme temperatures, etc..

 This product is not intended for use in residential locations.

18. Specifications and Restrictions

PRODUCT SPECIFICATIONS:

Overall dimensions: 239 mm W x 119.5 mm H x 22.5 mm D (including mounting tabs); 215 mm W excluding mounting tabs.

Weight: approximately 335 grams (~12 oz.; controller only, does not include mounting clips or screws)

Input power requirements: 18 VDC @ 2A (5.5 mm O.D. jack, center positive)

Outputs: 128 total outputs; 96 “high-density” outputs and 32 “high-current” outputs

High density outputs:

Max. current:	4 mA each
Max. driven area*:	0.2 m ² (2 ft ²)

High current outputs:

Max. current:	50 mA each
Max. driven area*:	2.5 m ² (26.9 ft ²)

Operating temperature range: 0 to 40 deg. C

Operating humidity range: 5 to 90% R.H., non-condensing

Storage temperature range: -20 to 65 deg. C

* Maximum active area of E Ink Prism™ material which may be driven by each output. Other limitations may apply depending on specific design of a given Prism™ tile.

 **WARNING:** This product is intended for interior use only, within the environmental conditions as described in the specifications section of this manual. It should not be installed or operated in any area or situation in which it will be exposed to water, chemicals, exposed flame or heat sources.

 **WARNING:** This product is to be used only in accordance with the directions included in this manual and other user documentation provided by E Ink. Failure to follow these directions may compromise the safety of the product.

3. Package Contents

Ensure that you have the following items before installing or using your controller:

Item	Quantity	Notes
E Ink ArC30™ Controller	1	-
Power supply	1	See Section 5
DIN rail mounting clips	2	See Section 6
Screws, #6 x 3/8"	4	
Ethernet cable (controller interconnect cable), 1 m	1	See Section 10
USB (A) to micro-USB (B) cable, 1m	1	See Section 9
User's manual	1	(This manual)

17. Software and Firmware Updates

The animation creation software, mobile control application, and the controller firmware may from time to time be updated by E Ink Corporation. Registered users of this controller product may receive notification of such updates via e-mail, or by checking for the latest revision at www.eink.com.

Updates to the controller firmware must be installed via the USB connection, using the E Ink Prism Design Studio™ software running on a compatible computer.

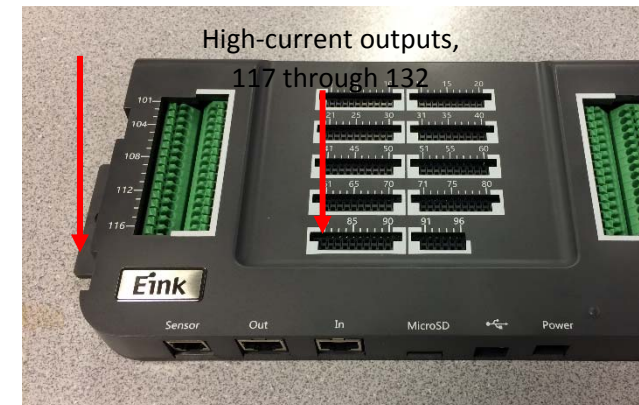
seeing faults or intermittent operation in such installations, try connecting a power supply to each controller in the system. If this corrects the problem, supplies may then be removed one at a time until the problem recurs. This will determine the minimum number of power supplies required for that installation.

4. Not all controllers have been programmed with the correct animation file(s) for all animations/playlists to be run by that system, or animation files have become corrupt. Check the files programmed into each controller via the E Ink Prism Design Studio™ software running on a computer connected to the system, or using the E Ink ArC™ mobile app on a Bluetooth device. Reprogram any missing or corrupt files using the E Ink Prism Design Studio™ software.

High-density outputs,
1 through 96

4. Controller Features

High-current outputs,
101 through 116



Sensor input
(see Sec. 14)

Micro SD card slot
(see Section 13)

*ArC30 controller
major features*

Controller
interconnect ports
(see Section 11)

Micro USB
Power input
(see Sec. 9)
18VDC, 2A max.
Center positive
(see Section 5)

and

5. Initial Power-up and Check

Perform the following steps to conduct an initial power up and basic unit check before installing or using the controller.

1. Ensure that no micro SD card is installed in the controller.
2. Locate the power supply provided with the controller. You will need to select an appropriate AC input adapter for your country or region from the set provided and attach it to the supply before using. Plug the supply's output cord into the controller's power input connector (see diagram on pg. 6) and plug the supply into a standard AC power outlet. The controller's green and yellow LEDs should light and blink in an alternating pattern. This indicates that the controller has powered up but that no animation files have been installed.
3. An E Ink Prism™ tile can be connected to any of the high-density outputs (1 through 96) or high-current outputs (101 through 132). When correctly connected to any output, the tile should change color in a regular cycle (see the table below for details on the power-up behavior of the controller outputs). See Section 7 for detailed instructions regarding the connection of tiles to the controller outputs.

software, and check to ensure that all desired animations have been programmed into the controller's memory. Note that in a multiple-controller installation, all controllers must be properly programmed with the correct animation file(s) for all animations/playlists to be run on that installation. Controllers with missing or corrupt animation files may be identified using the PC tool or the mobile app.

2. Missing or faulty micro SD™ card. If the custom animations are stored on micro-SD storage, the card must be installed and operating correctly. See Section 13.
3. Animation files corrupt; reprogram the animations using the E Ink Prism Design Studio™ software.
4. Controller may be faulty; try a different controller

Multiple controllers connected, but not all operate correctly

1. Make sure the inter-controller cables are connected properly; see Section 11. Note that the controllers should be connected such that the OUT connector of the first controller is connected to the IN connector of the second, and so on. Ensure that all cable connectors are seated properly.
2. Make sure that all inter-controller cables are 10 meters in length or shorter. Longer cables may result in incorrect operation of the system. Replace long cables with shorter cables to determine if cable length is affecting system operation.
3. While power is shared between controllers over the inter-controller cables, additional power supplies may be required in multi-controller installations. If you are

3. Faulty USB cable; replace the USB cable with another of the same type and try to connect via the computer again.
4. Try to connect to a different controller; if that connection works normally, replace the faulty controller.

Controller not responding to mobile app

1. Mobile device not properly paired to controller; see procedure in Section 12.
2. Controller not set to “master” mode. Note that the controller (or any one controller in a multi-controller installation) must be set to be the system “master” before the system can be controlled by the mobile app.
3. Mobile device out of range of controller. Move closer to the controller and try again.
4. Controller paired with a different mobile device (note that a master controller already paired with a Bluetooth device will not be visible to other devices); unpair that device and pair the controller/system with the desired mobile device.
5. Controller antenna blocked. See note in section 11.
6. Controller faulty; try a different controller as the system master.

Controller runs power-up animation OK (per pg. 6), but will not run custom animation(s)

1. No animations programmed. Connect the controller to a computer running the E Ink Prism Design Studio™

Outputs	Default power-up behavior
1-96	3 second flash transitions, off (white) – on (color) – off, in sequence through each 10-output section (i.e., output 1 cycles first, then output 2, etc.) with one second between each output.
101-104 and 117-132	On-off blinking, 1 second flash transitions, 3 seconds between transitions
105-108 and 121-124	On-off blinking, 3 second flash transitions, 3 seconds between transitions
109-112 and 125-128	On-off blinking, 5 second flash transitions, 3 seconds between transitions
113-116 and 129-132	1 second wave transitions, 3 seconds between transitions. Output pairs are (Side A/Side B): 113/114, 115/116, 129/130, and 131/132.

✓ Note that the behavior described above is controlled by a default animation file which is factory programmed. This animation will run automatically at power on, and will continue running until stopped by the control software running on a connected PC or laptop, or via Bluetooth® control using the mobile app. At that point, another animation file can be loaded onto the controller and started in its place. You may delete this default animation file (which is stored in the internal MCU flash memory) in order to free up storage space for your own animations.

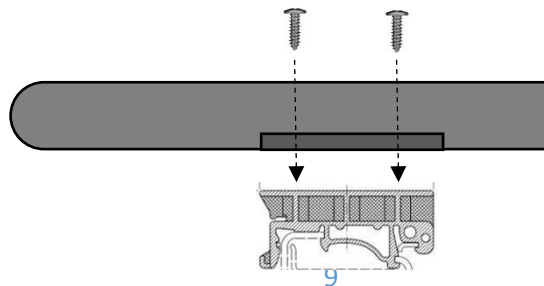
6. Installation and Mounting

The controller may be used as-is, mounted directly to a wall or other surface, or installed in a standard enclosure using the common “DIN rail” system (per standards EN 50022 or IEC 60715; 35 mm x 7.5 mm “top hat” rail). Mounting tabs are provided on either end of the controller case to facilitate either type of mounting.

To wall mount the controller: Use two #6 screws (not included), installed 22.5 cm (8.86”, approx. 8 $\frac{3}{8}$ ”) apart in the wall or other surface to which the controller is to be attached. Place the controller on the screws prior to tightening them, sliding the controller down such that the screws are in the center slots of the mounting tabs.

⚠ CAUTION: Do not over tighten the screws, as this may crack the mounting tabs and cause the controller to fall from the wall and damage the unit.

To mount the controller on a DIN rail: Locate the two DIN rail mounting clips and four screws provided with the controller. Mount the clips to the controller mounting tabs by aligning the mounting clip screw holes to the upper and lower holes in each tab and attaching with the screws provided, making sure that the clips are oriented as shown in the diagram below:



- b. More than one of the controllers is set to “master” mode, and this is making communications between controllers in the system impossible. Use the E Ink Prism Design Studio™ software to check each controller separately to make sure that only the one controller intended to be master for this system is set to that state, and that all the remaining controller are set to the “slave” mode.

One or more tiles/segments within the installation is/are not operating correctly

1. Ensure that the tile(s)/segment(s) involved are properly connected to their assigned outputs. Check against the original installation design to ensure that the proper outputs are being used for each tile or segment.
2. Faulty cable; check and/or replace the cable(s) connecting the malfunctioning tiles.
3. Replace the tile(s) involved. If this does not resolve the issue, this output is faulty. Replace the controller or re-assign the tile/segment involved to an unused output.

Controller not responding to computer

1. Bad USB connection; reseal the USB cable connectors at both the controller and the computer.
2. Reset the controller by disconnecting it from power for ten seconds, then reconnect the power and restart the Prism Design Studio™ software.

16. Troubleshooting

To troubleshoot problems with the Prism™ controller, please find the specific problem in the list below and follow the steps outlined to correct it. Please note that this section does not purport to cover all possible error/failure conditions or questions regarding this equipment and cannot provide for every contingency to be met in connection with the installation, operation, or maintenance of this or other E Ink products. If you cannot resolve an issue, please contact E Ink for support – see contact information in Section 20.

Unit/installation is not operating, no LEDs lit

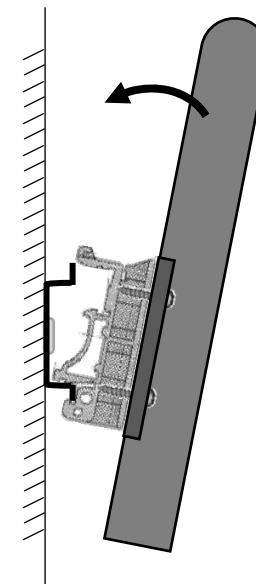
1. Power supply not connected correctly.
2. Power supply not plugged into working AC outlet. Check that AC outlet is live and wired correctly.
3. Power supply faulty; try a different supply.
4. Controller faulty; try a different controller.

Unit/installation not operating, but LEDs on/blinking

1. See the table on pg. 26 for information regarding the LED status indicators.
2. If several controllers in a multiple-controller installation are blinking yellow, the most likely problems are:
 - a. The controllers in the system did not power up simultaneously; restart the system with all controllers arranged to power up at the same time.

 **CAUTION:** Do not over tighten the screws, as this may crack the mounting tabs and/or damage the DIN rail mounting clips.

Once the clips are firmly attached to the controller, the controller may be installed in any standard enclosure using the DIN rail mounting system. To mount the controller onto the rail, place the lower lip of the rail into the slots at the bottom of each mounting clip, then push the top of the controller back until the top of the clips snap over the upper lip of the DIN rail.



 Note that mounting the controller (or specifically the master controller, in a multi-controller system) inside a metal enclosure or cabinet may interfere with the operation of the Bluetooth link.

7. Connecting E Ink Prism™ Tiles to the Controller

Each controller provides 128 outputs, each of which can be used to drive one single-segment E Ink Prism™ tile or one segment of a multi-segment tile. (Do not connect more than one tile or segment to any single output.) These outputs are organized into three groups. The first, located in the central area of the controller front panel and numbered 1 through 96, are referred to as the “high-density” (HD) outputs. These are used to drive smaller tiles/segments not requiring “wave” transitions. Each HD output is capable of driving a maximum area of 0.2 m² (2.1 ft²), “flash” transitions only.

The other two groups are the “high current” (HC) outputs, located on either side of the central HD block (see the diagram on pg. 8). There are a total of 32 HC outputs, with the left-hand group numbered 100-116 and the right-hand group numbered 117-132. (Note that numbers 97-100 are unused.) Each of these outputs is capable of driving a maximum area of 2.5 m² (26.9 ft²) in the flash transition mode. Wave transitions are also supported using the HC outputs, but this mode requires two outputs for each tile or segment. The total area supported is approximately the same for the wave transition mode, but there are additional restrictions on the aspect ratio of the tile if it is to be driven in this manner. The HC outputs support

15. LED Indicators

The controller provides two LED indicators on the front panel that are used to communicate system status. See the table below for the meanings of these indicators.

	Slow blink (1/4 Hz)	Medium blink (1 Hz)	Fast blink (4 Hz)	Solid ON (30 sec.)	On 2 sec., off 2 sec.
Green LED	System idle; no animation running	Animation running	N/A	Controller ID ¹	System rebooted
Yellow LED	N/A	Soft error detected ²	Critical error detected ³	N/A; if master, this LED is on continuously ⁴	

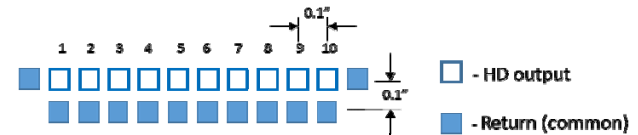
- 1 Triggered on command via a connected computer
- 2 Error may be corrected from a connected computer
- 3 Critical error; the system cannot run normally. There are a number of conditions which can cause this state; if a critical error is reported by any controller, use the Prism Design Studio™ software to access the system log files in order to determine the specific nature of the fault.
- 4 In a multi-controller system, the master controller will have its yellow LED on continuously.

listed here. In each case, “driver 1” refers to the output connected to the side of the tile or segment at which the transition is intended to start, and “driver 2” refers to the output connected to the opposite side (at which the transition will end). For more information regarding wave transitions, please see Section 7 of this manual.

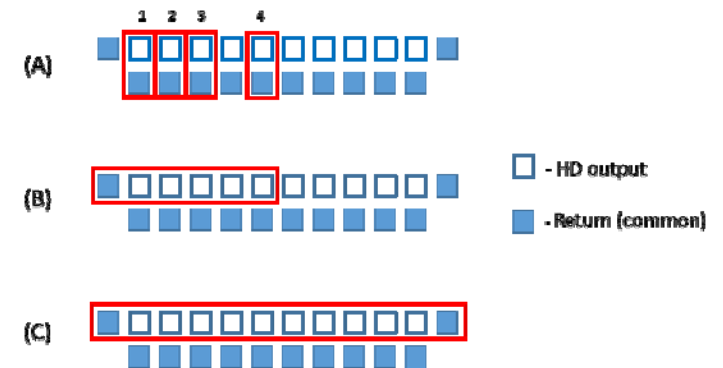
IMPORTANT NOTE: If an animation was previously playing on the master, it will not resume playing when any of the above commands are completed. It is up to the sensor to issue a PLAY command with the animation to be run in order to restart the animation.

discrete-wire connections only, and will accept conductors within the range of 20-24 AWG.

The HD outputs are organized in blocks of ten active outputs each; each block also provides 12 return connections. Each block appears as shown:



These outputs may be used in several ways. Individual tiles or segments may be connected using 2-pin headers as shown in example (A) below. Examples (B) and (C) show how multiple segments may be connected via a single header. In (B), five segments plus a common return are connected via a six-pin header. In (C), a twelve-pin header connects ten segments plus two common return lines.



Connectors for use with the HD outputs may be from any family providing standard 0.64 mm square pins on 2.54 mm

(0.1”) centers. For example, for use with discrete wires one may use Molex series 70021 male pins in series 70066 housings; for flat-flex cabling, a crimp-on connector such as the Amphenol 66226 “Clincher” series or equivalent may be used. When using crimp-on connectors, the use of the manufacturer’s recommended crimping tool is strongly recommended in order to ensure proper contact between the connector contacts and the conductors.



A note about “flash” and “wave” transitions: Tiles of E Ink’s Prism™ color-changing material may be designed to support either or both of two types of color transitions. The basic color change is referred to as a *flash* transition, in which the entire area of the tile or segment changes color at the same time. The other type is called a *wave* transition. In wave transitions, the color change starts at one side of the area and progresses smoothly to the opposite side. This requires a change to the physical design of the tile or segment, as a connection must be made at either side of the area (and the color change transition proceeds from one connection to the other). These must then connect to two outputs on the controller, as the tile area is driven in a “push-pull” fashion by these outputs. Also, due to the higher currents typically required by the wave transitions and the larger areas of material involved, they are supported only on the HC outputs.

- If the sensor device issuing this command is connected to a slave, only the slave will stop. Any subsequent PLAY commands from the master will be executed.

5. A DISPLAY STATIC IMAGE command:

- Will stop any animation or static image, clear the segments to white, and display the requested image
- This is always a local command. A master controller will not broadcast this command.
- If run on a slave: the slave will ignore any PLAY commands from the master until (a) the static image hold time is reached, or (b) a STOP command is received from the master or from the sensor

6. When a Display Static Image command is executed, all tiles/segments connected to that controller will initially be set to white, and then the static image will be applied as specified by the command data. It is not necessary – but will do no harm – to specify a transition on those tiles or segments remaining white.
7. Wave transitions can be used only with those tiles or segments capable of, and connected for, this transition type (i.e., there will be a connection at each end of the tile or segment, each going to two separate HC outputs on the ArC30 controller).
8. Wave transitions must always involve two HC outputs, with the transition type codes for those outputs being one of the pairs (0x10 and 0x20, 0x11 and 0x21, etc.)

NOTES:

1. All multiple-byte data is written and read as MSB first.
2. Detailed error messages are available in the system log files, readable via the Prism Design Studio™ software running on a computer connected to the system.
3. A PLAY command:
 - Will stop any animation or static image, clear the segments to white, and start the animation.
 - If the sensor device issuing the command is connected to a master, the above sequence will be broadcast to all slave controllers.
 - If the sensor device issuing the command is connected to a slave, only the slave will run the requested animation, and ignore any PLAY commands from the master until (a) the number of play loops is completed, or (b) a STOP command is received from the master or from the sensor
4. A STOP command:
 - Will stop any animation running or the timer on a static image being displayed
 - The segments will remain in their current state
 - If the sensor device issuing this command is connected to the master, the STOP command will be broadcast to all slave controllers.

8. Basic Operation

When power is connected, the controller will automatically power up (indicated by the green LED blinking) and drive the connected tiles according to whatever animation or playlist files have been installed. If no such files are found, the unit will still drive the connected tiles using its default standard drive sequence (see Section 5). During operation, the controller may be stopped and restarted, and the sequence of animations changed, via the control and monitoring application running on any compatible Bluetooth-enabled smartphone. See Section 12 for information about this application and pairing the controller with a specific device.

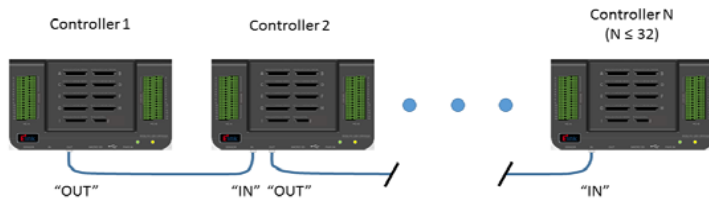
9. Connection to a PC and Programming

You can program the controller with new or updated animation control files and playlists using a computer running the E Ink Prism Design Studio™ software. The controller connects to the computer via a standard USB cable (included) through the micro USB port on the unit (see the picture in Section 4). Prior to connecting the unit to a computer for programming, ensure that sufficient storage has been installed for the animations to be programmed. See Section 13 for instructions regarding storage requirements and adding storage to the controller.

10.Connecting Multiple Controllers

Up to 32 controllers can be used in a single installation in order to support more tiles/segments or a greater active area of E Ink Prism™ material than can be connected to a single controller. In such cases, one controller acts as the system master controller and the rest are slave controllers, operating under the coordination of the master. Communication between controllers uses a CAN bus connection over standard Ethernet cabling with RJ45 connectors.

To chain multiple controllers together, use the Ethernet cables provided with each controller, or any standard Ethernet cables of up to 10 meters in length. (CAT6 cables are preferred.) Connect the “OUT” connector of the first controller to the “IN” connector of the second as shown, and so on until all required controllers are connected.



✓ Using Ethernet cables longer than 10 meters between any two controllers may have degrade system performance. It is strongly recommended that no cables longer than 10 meters are used at any point in a given installation.

⚠ When setting up a multi-controller installation all controllers must be connected together prior to applying power to the system and care should be taken in planning the power distribution so that all controllers power up at the same

Response codes

Code	Name	Meaning
0x80	RESP_SUCCESS	Command received & executed OK
0xFF	RESP_FAILED	Generic response for a failed command, no reason given
0xFD	RESP_ANIM_NOT_FOUND	The requested animation file is not on this controller
0xFA	RESP_NAME_TOO_LONG	The animation file name given is too long to be valid
0xF7	RESP_NO_WAVEFORM	The waveform file required to run the requested animation is missing or corrupt
0xEE	RESP_INVALID_CMD	The command received is invalid or not supported by the sensor protocol.
0xED	RESP_INVALID_PARAMS	One or more of the parameters required for this command is not valid
0xEB	RESP_15V_SUPPLIES_DOWN	The ±15V supplies for the controller outputs are not working, so the tiles will not switch correctly

Transition type codes

Code	Transition type
0x01	1-second flash
0x02	3-second flash
0x03	5-second flash
0x10	1-second wave, color → white, driver 1 (see notes 6, 7)
0x20	1-second wave, color → white, driver 2
0x30	1-second wave, white → color, driver 1
0x40	1-second wave, white → color, driver 2
0x11	3-second wave, color → white, driver 1
0x21	3-second wave, color → white, driver 2
0x31	3-second wave, white → color, driver 1
0x41	3-second wave, white → color, driver 2
0x12	5-second wave, color → white, driver 1
0x22	5-second wave, color → white, driver 2
0x32	5-second wave, white → color, driver 1
0x42	5-second wave, white → color, driver 2
All other code values are reserved and should not be used	

time. Failure to follow this requirement may result in the master controller being unable to properly configure and operate the system.

In a multiple-controller installation, one (and only one) controller must be designated as the “master” for the system. See section 10 of this manual for information on how to do this using the PC control software.

It is not required that the master controller be the first one in the physical arrangement (“Controller 1” in the diagram above). The master may be located at any point in the chain of connected controllers.

✓ In a multiple-controller system, the master controller may be identified by the fact that its yellow LED will be ON continuously. You can identify any controller in the system by requesting a controller ID (which sets the green LED ON for 30 seconds) via the control software. See Section 10.

Power is also shared between controllers via the interconnecting Ethernet cables, so that more than one controller may be powered from a single power supply, *if* none of the controllers is fully loaded in terms of the total driven area of Prism™ material connected.

⚠ When multiple power supplies are used within a single installation, all supplies must be powered from a single switchable circuit or otherwise connected so that all may be turned on and off simultaneously. (For example, all power supplies may be connected to a single switchable power strip or similar set of outlets.) Having one or more of the controllers in such an installation turned on or off before the others may result in the failure of the installation to properly initialize or

run the desired animations. Should this occur, shut down all controllers and then restart them simultaneously.

		be switched, four bytes as follows: Output number, 2 bytes (valid values: 1-96, 101-132) Desired state for this output, 1 byte 0x00 = color 0x0F = white Transition type, 1 byte (see table below)	set to white before the image is displayed. Hold time: In seconds; values 1-65535 sec., 0x0000 = “hold forever” (until next command). Value cannot be less than the specified transition time. See notes 5-8 on pg. 33-34.
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Command	Code	Total length/format	Notes
Play animation	0x01	Length 7-37 bytes Command , 1 byte Length , 2 bytes Number of times to play animation (2 bytes, MSB first; 0x0000 = “play indefinitely” (until stopped)) Name of animation file to be played ; null-terminated string, 2-32 bytes including termination.	Command will be ignored if the animation file specified does not exist on this controller. See note 3 on pg. 32 for detailed information regarding this command.
Stop animation	0x02	Length 3 bytes (command + 0x0000; no additional data allowed)	Stops whatever animation is currently running. See note 4 on pg. 32 for detailed information regarding this command.
Display Static Image	0x1F	Length Variable; up to 517 bytes maximum (all outputs switched). Command , 1 byte Length , 2 bytes Clear Ahead , 1 byte Hold time , 2 bytes For each output to	Clear Ahead: If zero, no segments will be cleared before displaying the image; otherwise, all segments/tiles connected to this controller will be

11. Basic Prism Design Studio Functions

The E Ink Prism Design Studio™ software permits users to design and implement E Ink Prism™ tile installations and their animations, as well as providing control and update functions for the controller(s) of these installations. Providing a complete set of instructions for this software is beyond the scope of this manual, but this section will document some of the basic procedures and functions relating to installing and operating an E Ink Prism™ tile installation using the E Ink Arc30™ controller. For information regarding the complete set of functions provided by this software and its operation, please consult the program’s own help feature and tutorials, and additional information which may be found online at www.eink.com.

Checking controller status

All active controllers in a system connected to the computer will be visible to the software and appear on its “Controller” screen, along with information describing the status of each controller. To access this information, select “Controllers” on the top line of the Design Studio screen. This will bring up a list of controllers with the following information:

- The controller serial number (or other ID number, if this has been set); this will be followed by either (Master) or (Slave) depending on the mode set for that controller.
- The communications port number

- The controller status (this should normally be “Healthy”)
- The version of the firmware currently installed on that controller
- The version of the waveform file currently installed on that controller
- Whether or not a micro SD card is installed in that controller.

✓ If a multi-controller system is connected before any controller in that system has been designated a “master,” or if the computer is connected to a “slave” controller instead of the system master, only the controller to which the computer is physically connected will appear in the controller list. (All controllers are set to “slave” mode as shipped.) If no other controllers are set as the system master (the “master” controller may be identified as its yellow LED will be on continuously), then you may set the controller to which the computer is connected as the system master (see below), at which time the other controllers in the system will be detected and will appear in the list. DO NOT set more than one controller in a system to master mode. Having two or more controllers set to “master” mode will prevent the system from operating correctly.

✓ For optimum performance, all controllers in any system should run the latest version of the Arc30™ firmware and waveform files. Please check this regularly, and obtain the latest files from www.eink.com.

Setting a controller to master or slave mode

There may be only one “master” controller in a given system at any one time. Before returning the system to normal

list of commands and response codes is given in the tables on the following pages.

to the sensor device, the 3.3V output may also be used by that device to determine if the controller is powered up.

The basic command protocol used by the controller (acting as an I²C master) for communications with a device (I²C slave) on this port is as follows:

1. The sensor device monitors the BUSY output; when this line is low, the sensor is clear to interrupt the controller.
2. The sensor device pulls the /INT line low to signal to the controller that it has a command to be executed.
3. The controller reads three bytes at the slave address:
 1. The command itself
 2. Two bytes (MSB first) giving a 16-bit value for the total number of bytes to be read (the "length code"; this value may be zero).
4. The controller then reads the number of additional bytes specified by the length code.
5. The controller executes the command.
6. The controller writes two bytes back to the sensor (slave) address:
 1. A response code, and
 2. The command originally received by the controller.

This protocol may be implemented using a number of different platforms for interfacing the actual sensor device with the ArC30 controller; for example, an Arduino microcontroller. A

operation, always ensure that only one controller is identified as the "master" in the Design Studio "Controllers" list. The master controller may also be identified by the fact that its yellow LED will be ON continuously. Follow these steps to change a controller's setting from "master" to "slave" or vice-versa:

1. Select the "Controllers" tab on the Design Studio program.
2. Ensure that the controller (or string of controllers in a multiple-controller installation is connected to the computer via USB, is/are powered on, and that the software has detected the controller or string. When detected, all controllers "seen" by the software will be shown by serial number or assigned ID in the controller list.
3. Click on the controller to be set.
4. Select "Set Controller Type" from the function list at the top of the screen.
5. On the pop-up dialog box, select "Master" or "Slave" and then press "OK."

Setting the controller password

Each controller can be programmed with a password that must be entered in order to access the controller via Bluetooth. The default password is "000000." It is strongly recommended that you change this password before using the controller in order to prevent unauthorized access to your system. The password may be set to any six-digit numeric string (e.g., "123456") as follows:

1. From the list on the "Controllers" screen, click the serial number to select the controller whose password is to be set.

2. Click "Set Bluetooth Password."
3. In the pop-up box, enter a six-digit password. Note that only numeric values are allowed, and all six digits must be entered.
4. After setting/changing a password, the master controller must be reset.

Identifying a controller in a multi-controller installation

To visibly identify a specific controller in a multi-controller installation:

1. From the list on the "Controllers" screen, click the serial number of the controller to be identified.
2. Click "Locate Controller"
The green LED on the selected controller will be set ON for 30 seconds. The LEDs will then resume their previous state.

14. Using the Sensor Input

The E Ink Arc30™ controller supports the use of a sensor or other external control device via an I²C connection provided on a standard RJ11 connector as shown in the diagram in Section 4. The pinout of this connector is as shown in the table below. Note that the controller can supply +3.3VDC at up to 100 mA via this port. The default assignment of these lines is as shown in the table below.

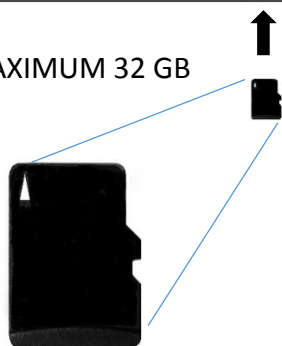
Pin	Assignment
1	GPIO 1 (/INT input)*
2	SCL
3	Ground
4	SDA
5	GPIO 2 (BUSY output)
6	+3.3 VDC (100 mA max.)

* This is an open drain input, with a pullup resistor within the Arc30 controller. The sensor should never actively drive this line high. The line is pulled low to request an interrupt, but otherwise the sensor output to this line should be in a high-impedance state.

The sensor device is an I²C slave, at an address stored as a persistent token in the controller's flash memory, programmed by the E Ink Prism Design Studio™ software. The sensor cannot use I²C address 0x55, as this address is used internally within the controller. In addition to providing up to 100 mA of current



⚠ MAXIMUM 32 GB



Ensure micro SD card is properly located in the card holder before pressing all the way into the slot.

12. Control via the Mobile App

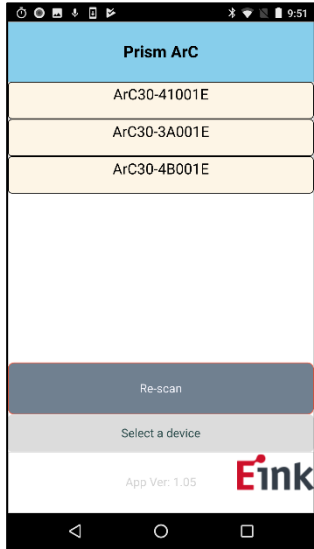
The E Ink ArC30™ controller provides Bluetooth connectivity so that it may be operated using the E Ink ArC Mobile App, available for iPhones or for Android smartphones.

Versions of this app are available for use on iPhones running iOS 10 and later, and on Android phones running the “Marshmallow” (version 6.0) or later version of that operating system. Tablets are not supported in either OS.

Using the mobile app, the complete controller system may be enabled/disabled, animations selected from those available in the system, and the status of the system obtained. (New animations cannot be programmed via this app.) Please see the documentation provided with the app for detailed instructions.

✓ Bluetooth control of the system is via communications with the master controller only. The Bluetooth device running the mobile control app must therefore be in range of that particular controller. The master controller is identified by having its yellow LED on continuously, or it can be identified using a command from a USB-connected computer running the E Ink Prism Design Studio™ animation creation software or via the E Ink ArC mobile app.

Pairing a Bluetooth device with the ArC30™ controller –When the E Ink ArC mobile app is run on a Bluetooth-capable smartphone, a list of active master controllers in the vicinity will appear on the screen, identified by serial number. Or, if

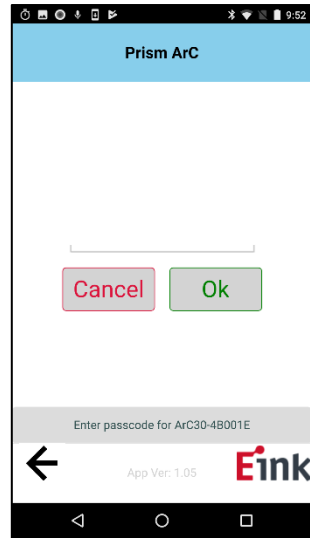


controller numbers within a given installation have been assigned using the E Ink Prism Design Studio software, these numbers will appear. Note that only controllers set to the “master” mode will appear in this list.

Select the desired controller/installation by tapping on its number in the list; you will then be prompted to enter the password for that controller. Passwords are assigned during the controller setup using the Prism

Design Studio software; see Section 10 of this document. Once successfully paired with that controller, the mobile app will permit you to review the animations and playlists stored in that installation, start and stop them, and to monitor the status of all controllers that installation. Please see the examples on the following pages.

⚠ The ArC30 controller’s Bluetooth antenna is located near the upper corner of the unit, just the rightmost HC output connectors (HC outputs 132). Keep metallic objects, including cabling, from this area. Also note Bluetooth communications



within
see

right
above

117-

away
that
may

13. File Storage

Each controller provides 320 KB of internal flash storage; this is sufficient for the storage of up to eight animation files of 40 KB each. This is the maximum animation file size allowed when only this internal storage is available and is sufficient for approx. 76 seconds per file (assuming all outputs switching once per second).

If additional storage space is desired, or if animation files larger than 40 KB are to be used, you may install a standard micro SD card of up to 32 GB in the slot provided. To install the card, simply insert it into the slot as shown on the following page and press until the card locks into the slot. To remove the card, press on the edge of the card to release it and then extract it from the slot.

- ✓ The SD card holder is set back a few millimeters from the opening in the case. When inserting an SD card, ensure that the card is entering the SD card holder before pressing it all the way in to lock it into the slot. A thin tool such as a small, non-conductive flat-blade screwdriver may be useful in seating the card into the holder, or releasing it for extraction.

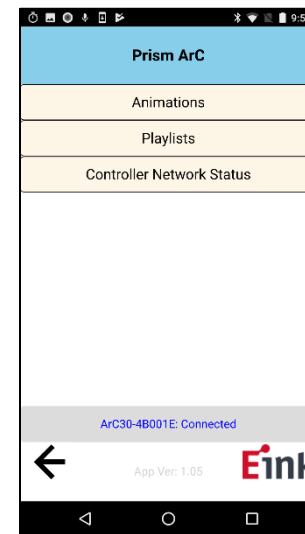
Selecting a running animation or playlist will bring up a similar dialog which will permit the user to stop that animation.

not work or be very limited in range if the controller is installed within a metal enclosure.

Checking the status of controllers within the installation

Once the mobile app has identified a master controller within range, and the correct password for that controller has been entered, the main screen of the app will appear as shown:

Note that the ID of the connected controller appears at the bottom of this screen.

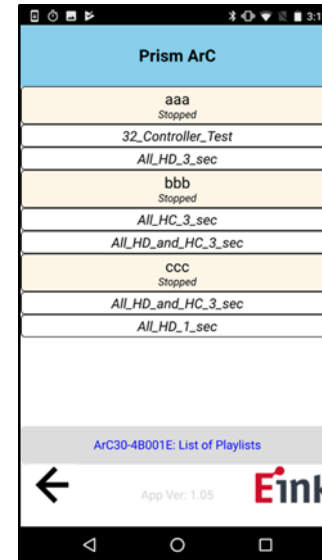


To check the status of all controllers in this system (i.e., the master controller and any others connected to it via the CAN bus network), tap on "Controller Network Status" from this screen. You will then see a screen listing the controllers in this system, which will appear as shown at left.

On this screen, every controller in the system to which the app is currently paired will be listed by ID number, along with

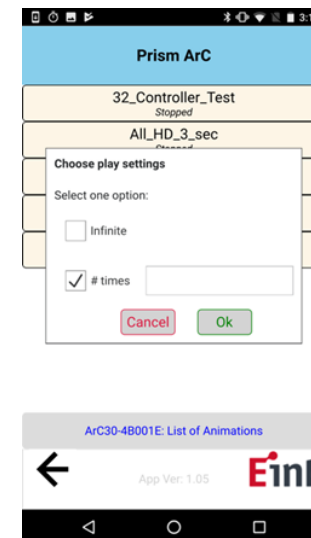


whether that controller is set to “master” or “slave” mode, its current “health” status, and whether or not that controller contains a micro-SD card.



Reviewing animations & playlists

If “Animations” or “Playlists” is selected from the main screen, a list of these will appear as shown (this example is the Animations list). Each animation or playlist file is listed by name, along with its current status (“Stopped” or “Running”).



Starting and stopping animations and playlists

Selecting any animation or playlist listed as “stopped” from the list will cause a dialog box to appear as shown. At this point, you may choose to run the animation a specific number of times, or to loop “forever” (until stopped). The animation will run immediately after selecting “OK” from this box.