

# MicroHAWK V420-F

## Autofocus Multicode Reader




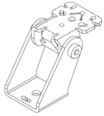

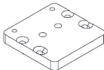
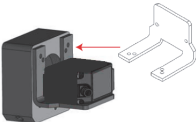
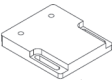
### Autofocus to read codes at different distances.

- Simple configuration with WebLink.
- 5 megapixel sensor available.
- Autofocus available.
- Serial RS-232, USB, or Ethernet over USB.
- IP54.
- Corner-exit cable.



## MicroHAWK V420-F

### Mounting Options

| Appearance  | Type   | Part Number |
|---|--|-------------|
|   | L Bracket Adjustable Angle Mounting Kit                  | V430-AM0    |
|  | 1/4-20 Camera Mounting Block Kit                         | V430-AM1    |
|  | 4" (102 mm) Ram Mount Stand                              | V430-AM2    |
|  | APG Pan and Tilt Camera Mount                            | V430-AM3    |
|  | Nylon Screw and Washer Electrical Isolation Mounting Kit | V430-AM4    |
|  | MS-4 / MINI to V/F4XX-F Adapter Plate                    | V430-AM5    |
|  | Smart Ring Light to V/F4XX-F Mounting Bracket            | V430-AM6    |
|  | QX / Vision HAWK to V/F4XX-F Adapter Plate               | V430-AM7    |

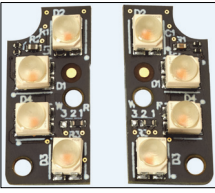
## Optics Options

| Appearance  | Type                                  | Part Number |
|---|---------------------------------------|-------------|
|    | Front Window – Installation Kit       | V430-AF10 * |
|    | Diffuser – Installation Kit           | V430-AF11 * |
|    | Polarizer – Installation Kit          | V430-AF12 * |
|    | Right Angle Mirror – Installation Kit | V430-AF3    |
|    | YAG Filter – Installation Kit         | V430-AF4    |
|   | ESD-Safe Window – Installation Kit    | V430-AF5    |
|  | Red Filter – Installation Kit         | V430-AF6    |
|  | Blue Filter – Installation Kit        | V430-AF7    |

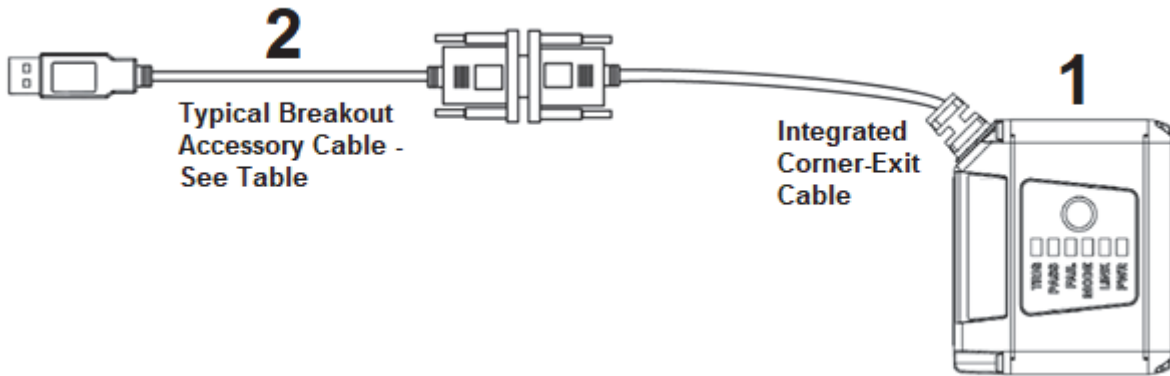
\* Note: V430-AF10, AF11, and AF12 are used for **MicroHAWK V/F4X0-FXXXXXXX-XXX** readers in this datasheet. The prior generation **MicroHAWK V430-FXXXXXXX** code reader uses part numbers V430-AF0, AF1, and AF2. Please select the correct accessory from the table based on your reader part number format.

| Accessory                     | Prior V430-FXXXXXXX Code Reader | New V/F4X0-FXXXXXXX-XXX Code Reader and Smart Camera |
|-------------------------------|---------------------------------|--|
| Front Window Installation Kit | V430-AF0                        | V430-AF10  |
| Diffuser Installation Kit     | V430-AF1                        | V430-AF11  |
| Polarizer Installation Kit    | V430-AF2                        | V430-AF12  |

## Lighting Options

| Appearance  | Type                           | Part Number |
|---|--------------------------------|-------------|
|  | Red Light – Installation Kit   | V430-ALR    |
|   | White Light – Installation Kit | V430-ALW    |
|   | Blue Light – Installation Kit  | V430-ALB    |
|   | IR Light – Installation Kit    | V430-ALI    |

Wiring Options



| Drawing Reference                                    | Appearance  | Category                                       | Length / Spec  | Part Number   |
|--|---|--|--|---------------|
| 2  | Accessory USB Cable To Host                       | USB Breakout Cable                             | 1 Meter  | V420-WUB-1M   |
|  | Accessory USB Cable To Host<br>Power Supply       | Cable – USB Breakout with External Power Input | 1 Meter  | V420-WUX-1M   |
|  |   | Power Supply                                   | 2 Meters   | 97-9000006-01 |
|  | Kit – Cable and Power Supply                      | Kit – Cable and Power Supply                   |  | V420-AC1      |
|  |   | To Host<br>Power Supply                        | Cable – RS-232 Breakout (DB-15) and External Power Input | 1 Meter       |
|  | Power Supply                                      | Power Supply                                   | 2 Meters   | 97-9000006-01 |
|  |   | Kit – Cable and Power Supply                   |  | V420-AC0      |
| IO<br>Accessory USB Cable To Host<br>To Power Supply | Cable – USB, IO, and Power Breakout               | 1 Meter  | V420-WU8X-1M   |               |
|  | Power Supply                                      | 2 Meters                                       | 97-000011-02   |               |
| Kit – Cable and Power Supply                         | Kit – Cable and Power Supply                      |  | V420-AC2   |               |
|  | IO<br>USB Breakout<br>To Power<br>RS-232 Breakout | Cable – RS-232, USB, IO, and Power Breakout    | 1 Meter  | V420-WRU8X-1M |
| Power Supply   | Power Supply                                      | 2 Meters                                       | 97-000011-02   |               |
|  | Cable – Trigger, IO, and Power Breakout           | 900 MM   | 61-000151-01   |               |

# V420-F

## V420-F Part Number Structure

Use this legend when defining product part numbers. Please note that not all combinations of parameters are valid. For instance, color cameras are only available with white lighting, and 400 mm fixed focus is only available with UHD lenses. When ordering, use valid part numbers from the tables in the Ordering Information section only.

### V420-F[XXX][Y][ZZZ]-[L][C][P]

| Key | Classification      | Code | Meaning   |
|-----|---------------------|------|---|
| XXX | Focus Distance (mm) | 000  | Autofocus – Variable Distance                           |
|     |                     | 050  | Fixed Focus at 50 mm                                    |
|     |                     | 064  | Fixed Focus at 64 mm                                    |
|     |                     | 081  | Fixed Focus at 81 mm                                    |
|     |                     | 102  | Fixed Focus at 102 mm                                   |
|     |                     | 133  | Fixed Focus at 133 mm                                   |
|     |                     | 190  | Fixed Focus at 190 mm                                   |
|     |                     | 300  | Fixed Focus at 300 mm                                   |
|     |                     | 400  | Fixed Focus at 400 mm                                   |
| Y   | Lens                | W    | Wide Field of View – 5.2 mm Focal Length Lens           |
|     |                     | M    | Medium Field of View – 7.7 mm Focal Length Lens         |
|     |                     | N    | Narrow Field of View – 16 mm Focal Length Lens          |
|     |                     | L    | Narrow 16 mm Lens – Autofocus to 1160 mm                |
| ZZZ | Sensor              | 03M  | 752 x 480 (0.3 MP) Pixel, Mono Sensor, Global Shutter   |
|     |                     | 12M  | 1280 x 960 (1.2 MP) Pixel, Mono Sensor, Global Shutter  |
|     |                     | 50C  | 2592 x 1944 (5 MP) Pixel, Color Sensor, Rolling Shutter |
| L   | Light Type          | N    | No Outer Light  |
|     |                     | S    | Standard Outer Light                                    |
| C   | Light Color         | N    | No Outer Light  |
|     |                     | R    | Red   |
|     |                     | W    | White   |
| P   | Software License    | P    | High Speed, Plus Mode                                   |
|     |                     | X    | High Speed, X-Mode                                      |

#### Example Part Numbers:

- V420-F081W03M-NNP: Fixed Focus at 81 mm, Wide Lens, 0.3 MP Monochrome Sensor, No Outer Light, High Speed, Plus Mode
- V420-F000W50C-SWP: Autofocus, Wide Lens, 5 MP Color, Standard Light, White, High Speed, Plus Mode

## V420-F Valid Product Matrix

| Model  | Category   | Focus Type           | Sensor   | Lens    | Focus Distance (mm)                              | Light            | License |
|--------|------------|----------------------|----------|---------|--|------------------|---------|
| V420-F | Monochrome | Fixed Focus          | 03M, 12M | W, M    | 50, 64, 81, 102, 133, 190, 300                   | None, Red, White | P, X    |
|        |            |                      | 12M      | N       | 64, 400  | None, Red, White | P, X    |
|        |            | Autofocus            | 03M      | W, M    | 50 <-> 300 Autofocus                             | None, Red, White | P, X    |
|        |            |                      | 12M      | W, M, N | 50 <-> 300 (W, M)<br>40 <-> 150 (N)<br>Autofocus | None, Red, White | P, X    |
|        | Color      | Fixed Focus          | 50C      | W, M    | 50, 64, 81, 102, 133, 190, 300                   | None, White      | P, X    |
|        |            | Autofocus            | 50C      | W, M    | 50 <-> 300 Autofocus                             | None, White      | P, X    |
|        | Specialty  | Long Range Autofocus | 12M      | L       | 75 <-> 1160 Autofocus                            | None, Red, White | P, X    |

## V420-F Ordering Information

### Categories:

#### 1. Fixed Focus Camera

- a.) V420-F Monochrome Fixed Focus Camera
- b.) V420-F Color Fixed Focus Camera
- c.) V420-F 1.2 MP Monochrome Fixed Focus Camera with Narrow Lens

#### 2. Autofocus Camera

- a.) V420-F 0.3 MP Monochrome Autofocus Camera (50 -300 mm)
- b.) V420-F 1.2 MP Monochrome Autofocus Camera (50 – 300 mm for Wide and Medium Lens, 40 – 150 mm for Narrow Lens)
- c.) V420-F Color Autofocus Camera (50 - 300 mm)
- d.) V420-F 1.2 MP Monochrome Long Range Autofocus Camera (75 - 1160 mm)

### 1a) V420-F Monochrome Fixed Focus Camera: Valid Combinations

V420-F[XXX][Y][ZZZ]-[L][C][P]

| Key | Classification      | Code | Meaning  |
|-----|---------------------|------|--|
| XXX | Focus Distance (mm) | 050  | Fixed Focus at 50 mm                                   |
|     |                     | 064  | Fixed Focus at 64 mm                                   |
|     |                     | 081  | Fixed Focus at 81 mm                                   |
|     |                     | 102  | Fixed Focus at 102 mm                                  |
|     |                     | 133  | Fixed Focus at 133 mm                                  |
|     |                     | 190  | Fixed Focus at 190 mm                                  |
|     |                     | 300  | Fixed Focus at 300 mm                                  |
| Y   | Lens                | W    | Wide Field of View - 5.2 mm Focal Length Lens          |
|     |                     | M    | Medium Field of View – 7.7 mm Focal Length Lens        |
| ZZZ | Sensor              | 03M  | 752 x 480 (0.3 MP) Pixel, Mono Sensor, Global Shutter  |
|     |                     | 12M  | 1280 x 960 (1.2 MP) Pixel, Mono Sensor, Global Shutter |
| L   | Light Type          | N    | No Outer Light   |
|     |                     | S    | Standard Outer Light                                   |
| C   | Light Color         | N    | No Outer Light   |
|     |                     | R    | Red  |
|     |                     | W    | White  |
| P   | Software License    | P    | High Speed, Plus Mode                                  |
|     |                     | X    | High Speed, X-Mode                                     |

### 1b) V420-F 5.0 MP Color Fixed Focus Camera: Valid Combinations

**Note:** 5 MP Color cameras are available with No Outer Light or White Light options only.

V420-F[XXX][Y]50C-[L][C][P]

| Key | Classification      | Code | Meaning   |
|-----|---------------------|------|---|
| XXX | Focus Distance (mm) | 050  | Fixed Focus at 50 mm                            |
|     |                     | 064  | Fixed Focus at 64 mm                            |
|     |                     | 081  | Fixed Focus at 81 mm                            |
|     |                     | 102  | Fixed Focus at 102 mm                           |
|     |                     | 133  | Fixed Focus at 133 mm                           |
|     |                     | 190  | Fixed Focus at 190 mm                           |
|     |                     | 300  | Fixed Focus at 300 mm                           |
| Y   | Lens                | W    | Wide Field of View - 5.2 mm Focal Length Lens   |
|     |                     | M    | Medium Field of View – 7.7 mm Focal Length Lens |
| L   | Light Type          | N    | No Outer Light                                  |
|     |                     | S    | Standard Outer Light                            |
| C   | Light Color         | N    | No Outer Light                                  |
|     |                     | W    | White   |
| P   | Software License    | P    | High Speed, Plus Mode                           |
|     |                     | X    | High Speed, X-Mode                              |

## V420-F

### 1c) V420-F 1.2 MP Monochrome Fixed Focus Camera with Narrow Lens: Valid Combinations

Note: Fixed Focus Narrow lens option available for 1.2 MP Mono camera only.

#### V420-F[XXX]N12M-[L][C][P]

| Key | Classification      | Code | Meaning               |
|-----|---------------------|------|-----------------------|
| XXX | Focus Distance (mm) | 064  | Fixed Focus at 64 mm  |
|     |                     | 400  | Fixed Focus at 400 mm |
| L   | Light Type          | N    | No Outer Light        |
|     |                     | S    | Standard Outer Light  |
| C   | Light Color         | N    | No Outer Light        |
|     |                     | R    | Red                   |
|     |                     | W    | White                 |
| P   | Software License    | P    | High Speed, Plus Mode |
|     |                     | X    | High Speed, X-Mode    |

### 2a) V420-F 0.3 MP Monochrome Autofocus Camera (50 - 300 mm): Valid Combinations

#### V420-F000[Y]03M-[L][C][P]

| Key | Classification   | Code | Meaning   |
|-----|------------------|------|---|
| Y   | Lens             | W    | Wide Field of View - 5.2 mm Focal Length Lens   |
|     |                  | M    | Medium Field of View – 7.7 mm Focal Length Lens |
| L   | Light Type       | N    | No Outer Light                                  |
|     |                  | S    | Standard Outer Light                            |
| C   | Light Color      | N    | No Outer Light                                  |
|     |                  | R    | Red   |
|     |                  | W    | White   |
| P   | Software License | P    | High Speed, Plus Mode                           |
|     |                  | X    | High Speed, X-Mode                              |

### 2b) V420-F 1.2 MP Monochrome Autofocus Camera (50 – 300 mm for Wide and Medium, 40 – 150 mm for Narrow): Valid Combinations

#### V420-F000[Y]12M-[L][C][P]

| Key | Classification   | Code | Meaning   |
|-----|------------------|------|---|
| Y   | Lens             | W    | Wide Field of View - 5.2 mm Focal Length Lens   |
|     |                  | M    | Medium Field of View – 7.7 mm Focal Length Lens |
|     |                  | N    | Narrow Field of View – 16 mm Focal Length Lens  |
| L   | Light Type       | N    | No Outer Light                                  |
|     |                  | S    | Standard Outer Light                            |
| C   | Light Color      | N    | No Outer Light                                  |
|     |                  | R    | Red   |
|     |                  | W    | White   |
| P   | Software License | P    | High Speed, Plus Mode                           |
|     |                  | X    | High Speed, X-Mode                              |

### 2c) V420-F 5.0 MP Color Autofocus Camera (50 - 300 mm): Valid Combinations

Note: Narrow Autofocus lens option not available for color camera.

#### V420-F000[Y]50C-[L][C][P]

| Key | Classification   | Code | Meaning   |
|-----|------------------|------|---|
| Y   | Lens             | W    | Wide Field of View - 5.2 mm Focal Length Lens   |
|     |                  | M    | Medium Field of View – 7.7 mm Focal Length Lens |
| L   | Light Type       | N    | No Outer Light                                  |
|     |                  | S    | Standard Outer Light                            |
| C   | Light Color      | N    | No Outer Light                                  |
|     |                  | W    | White   |
| P   | Software License | P    | High Speed, Plus Mode                           |
|     |                  | X    | High Speed, X-Mode                              |

## 2d) V420-F 1.2 MP Monochrome Long Range Autofocus Camera (75 - 1160 mm): Valid Combinations

**Note:** Autofocus Long Range lens option available for 1.2 MP Monochrome camera only.

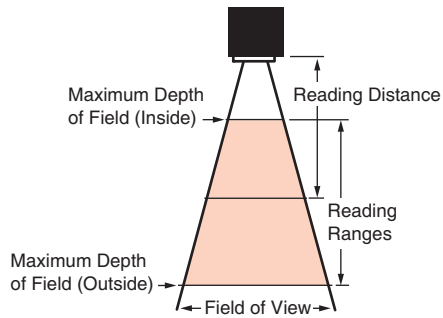
### V420-F000L12M-[L][C][P]

| Key | Classification   | Code | Meaning               |
|-----|------------------|------|-----------------------|
| L   | Light Type       | N    | No Outer Light        |
|     |                  | S    | Standard Outer Light  |
| C   | Light Color      | N    | No Outer Light        |
|     |                  | R    | Red                   |
|     |                  | W    | White                 |
| P   | Software License | P    | High Speed, Plus Mode |
|     |                  | X    | High Speed, X-Mode    |

# V420-F

## Field of View Charts

Specifications are subject to change.



### Fixed Focus Field of View (mm) - Wide Lens

| Distance (mm) | 0.3 MP |        | 1.2 MP |        | 5 MP  |        |
|---------------|--------|--------|--------|--------|-------|--------|
|               | Width  | Height | Width  | Height | Width | Height |
| 50            | 49     | 32     | 53     | 39     | 50    | 38     |
| 64            | 62     | 39     | 66     | 49     | 63    | 47     |
| 81            | 76     | 49     | 81     | 61     | 78    | 58     |
| 102           | 95     | 60     | 101    | 75     | 96    | 72     |
| 133           | 121    | 78     | 129    | 97     | 124   | 92     |
| 190           | 171    | 109    | 182    | 136    | 174   | 130    |
| 300           | 266    | 170    | 283    | 213    | 271   | 202    |

### Fixed Focus Field of View (mm) - Medium Lens

| Distance (mm) | 0.3 MP |        | 1.2 MP |        | 5 MP  |        |
|---------------|--------|--------|--------|--------|-------|--------|
|               | Width  | Height | Width  | Height | Width | Height |
| 50            | 34     | 22     | 36     | 27     | 35    | 26     |
| 64            | 43     | 27     | 45     | 34     | 43    | 32     |
| 81            | 53     | 34     | 56     | 42     | 54    | 40     |
| 102           | 66     | 42     | 70     | 52     | 67    | 50     |
| 133           | 84     | 54     | 90     | 67     | 86    | 64     |
| 190           | 119    | 76     | 126    | 95     | 121   | 90     |
| 300           | 185    | 118    | 196    | 147    | 188   | 140    |

### Fixed Focus Field of View (mm) - Narrow Lens

| Distance (mm) | 1.2 MP |        |
|---------------|--------|--------|
|               | Width  | Height |
| 64            | 21     | 15     |
| 400           | 118    | 88     |



### Autofocus Field of View (mm) - Wide Lens

| Distance (mm) | 0.3 MP |        | 1.2 MP |        | 5 MP  |        |
|---------------|--------|--------|--------|--------|-------|--------|
|               | Width  | Height | Width  | Height | Width | Height |
| 50            | 51     | 33     | 55     | 41     | 52    | 39     |
| 100           | 97     | 62     | 103    | 77     | 98    | 73     |
| 150           | 142    | 90     | 151    | 113    | 144   | 107    |
| 200           | 187    | 119    | 199    | 149    | 190   | 142    |
| 250           | 232    | 148    | 247    | 185    | 236   | 176    |
| 300           | 277    | 177    | 295    | 221    | 282   | 210    |

### Autofocus Field of View (mm) - Medium Lens

| Distance (mm) | 0.3 MP |        | 1.2 MP |        | 5 MP  |        |
|---------------|--------|--------|--------|--------|-------|--------|
|               | Width  | Height | Width  | Height | Width | Height |
| 50            | 33     | 21     | 36     | 27     | 34    | 25     |
| 100           | 63     | 40     | 67     | 50     | 64    | 48     |
| 150           | 92     | 59     | 98     | 73     | 94    | 70     |
| 200           | 121    | 77     | 129    | 97     | 123   | 92     |
| 250           | 151    | 96     | 160    | 120    | 153   | 114    |
| 300           | 180    | 115    | 191    | 144    | 183   | 136    |

### Autofocus Field of View (mm) - Narrow Lens

| Distance (mm) | 1.2 MP |        |
|---------------|--------|--------|
|               | Width  | Height |
| 50            | 16     | 12     |
| 100           | 31     | 23     |
| 150           | 45     | 34     |

### Long Range Autofocus Field of View (mm)

| Distance (mm) | 1.2 MP |        |
|---------------|--------|--------|
|               | Width  | Height |
| 75            | 24     | 18     |
| 100           | 31     | 23     |
| 200           | 60     | 45     |
| 300           | 89     | 67     |
| 400           | 118    | 88     |
| 500           | 147    | 110    |
| 600           | 176    | 132    |
| 700           | 204    | 153    |
| 800           | 233    | 175    |
| 900           | 262    | 197    |
| 1000          | 291    | 218    |
| 1200          | 349    | 262    |
| 1300          | 378    | 283    |
| 1400          | 407    | 305    |
| 1500          | 436    | 327    |

# Readability Tables

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The readability tables on the following pages are designed to help users choose the best read-distance, sensor, and lens combination to read their particular code size and code type successfully.

The readability tables show the calculated PPE (pixels per element) for a range of typical code sizes at all the MicroHAWK Fixed Focus distances with the Wide, Medium, Narrow, and Long Range lens as well as with the 0.3MP, 1.2MP, and 5MP sensors.

PPE is defined as the following for 1D and 2D codes:

- PPE for 1D codes is the number of pixels across the thinnest bar in the barcode.
- PPE for 2D codes is the number of pixels across a single code cell.

The tables show a color code for readability based on Direct Part Marks (DPM) where red means not likely to read, and green means that it should read. The tables also show a range of colors between red and green, while showing the zone where read rates may be acceptable for high-contrast, well-printed labels and can be considered. See the 1D and 2D Code Readability Guidelines below for Minimum and Preferred PPE for both DPM marks and high-contrast labels.



## 1D Code Readability Guidelines

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### High-Contrast Labels

- 1.5 pixels per thin bar is suggested minimum;
- 2 pixels or more per thin bar is preferred.

### Direct Part Marks

- 2 pixels per thin bar is suggested minimum;
- 2.5 pixels or more per thin bar is preferred.

## 2D Code Readability Guidelines

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### High-Contrast Labels

- 2.5 – 2.75 pixels per 2D cell is suggested minimum;
- 3.5 – 5 pixels per 2D cell is preferred.

### Direct Part Marks

- 3.25 pixels per 2D Cell is suggested minimum;
- 4 – 6 pixels per 2D Cell is preferred.

# Readability Table – 0.3 Megapixel

= Maximum Readability  
 = Minimum Readability

| 0.3 Megapixel – Pixels Per Element / Readability Chart |   |      |      |      |      |      |     |     |             |   |      |      |      |      |      |     |     |
|--|---|------|------|------|------|------|-----|-----|-------------|---|------|------|------|------|------|-----|-----|
| Minimum Element Size                                   | Readability of 1D Code at Distance (mm) |      |      |      |      |      |     |     | Lens        | Readability of 2D Code at Distance (mm) |      |      |      |      |      |     |     |
|  | 50                                      | 64   | 81   | 102  | 133  | 190  | 300 | 400 |             | 50                                      | 64   | 81   | 102  | 133  | 190  | 300 | 400 |
| 2 mil  | 0.7                                     | 0.6  | 0.5  | 0.4  | 0.3  | 0.2  | 0.1 | 0.1 | Wide Lens   | 0.7                                     | 0.6  | 0.5  | 0.4  | 0.3  | 0.2  | 0.1 | 0.1 |
| 2.5 mil  | 0.9                                     | 0.7  | 0.6  | 0.5  | 0.4  | 0.3  | 0.2 | 0.1 |             | 0.9                                     | 0.7  | 0.6  | 0.5  | 0.4  | 0.3  | 0.2 | 0.1 |
| 3.3 mil  | 1.2                                     | 1.0  | 0.8  | 0.6  | 0.5  | 0.4  | 0.2 | 0.2 |             | 1.2                                     | 1.0  | 0.8  | 0.6  | 0.5  | 0.4  | 0.2 | 0.2 |
| 5 mil  | 1.9                                     | 1.5  | 1.2  | 1.0  | 0.8  | 0.5  | 0.3 | 0.3 |             | 1.9                                     | 1.5  | 1.2  | 1.0  | 0.8  | 0.5  | 0.3 | 0.3 |
| 7.5 mil  | 2.8                                     | 2.2  | 1.8  | 1.5  | 1.1  | 0.8  | 0.5 | 0.4 |             | 2.8                                     | 2.2  | 1.8  | 1.5  | 1.1  | 0.8  | 0.5 | 0.4 |
| 10 mil   | 3.7                                     | 3.0  | 2.4  | 1.9  | 1.5  | 1.1  | 0.7 | 0.5 |             | 3.7                                     | 3.0  | 2.4  | 1.9  | 1.5  | 1.1  | 0.7 | 0.5 |
| 15 mil   | 5.6                                     | 4.5  | 3.6  | 2.9  | 2.3  | 1.6  | 1.0 | 0.8 |             | 5.6                                     | 4.5  | 3.6  | 2.9  | 2.3  | 1.6  | 1.0 | 0.8 |
| 20 mil   | 7.4                                     | 6.0  | 4.8  | 3.9  | 3.0  | 2.1  | 1.4 | 1.0 |             | 7.4                                     | 6.0  | 4.8  | 3.9  | 3.0  | 2.1  | 1.4 | 1.0 |
| 30 mil   | 11.1                                    | 8.9  | 7.2  | 5.8  | 4.5  | 3.2  | 2.1 | 1.6 |             | 11.1                                    | 8.9  | 7.2  | 5.8  | 4.5  | 3.2  | 2.1 | 1.6 |
| 40 mil   | 14.9                                    | 11.9 | 9.6  | 7.8  | 6.0  | 4.3  | 2.8 | 2.1 |             | 14.9                                    | 11.9 | 9.6  | 7.8  | 6.0  | 4.3  | 2.8 | 2.1 |
| 2 mil  | 1.2                                     | 1.0  | 0.8  | 0.6  | 0.5  | 0.3  | 0.2 | 0.2 | Medium Lens | 1.2                                     | 1.0  | 0.8  | 0.6  | 0.5  | 0.3  | 0.2 | 0.2 |
| 2.5 mil  | 1.5                                     | 1.2  | 1.0  | 0.8  | 0.6  | 0.4  | 0.3 | 0.2 |             | 1.5                                     | 1.2  | 1.0  | 0.8  | 0.6  | 0.4  | 0.3 | 0.2 |
| 3.3 mil  | 2.0                                     | 1.6  | 1.3  | 1.0  | 0.8  | 0.6  | 0.4 | 0.3 |             | 2.0                                     | 1.6  | 1.3  | 1.0  | 0.8  | 0.6  | 0.4 | 0.3 |
| 5 mil  | 3.0                                     | 2.4  | 1.9  | 1.6  | 1.2  | 0.9  | 0.6 | 0.4 |             | 3.0                                     | 2.4  | 1.9  | 1.6  | 1.2  | 0.9  | 0.6 | 0.4 |
| 7.5 mil  | 4.5                                     | 3.6  | 2.9  | 2.3  | 1.8  | 1.3  | 0.8 | 0.6 |             | 4.5                                     | 3.6  | 2.9  | 2.3  | 1.8  | 1.3  | 0.8 | 0.6 |
| 10 mil   | 5.9                                     | 4.8  | 3.8  | 3.1  | 2.4  | 1.7  | 1.1 | 0.8 |             | 5.9                                     | 4.8  | 3.8  | 3.1  | 2.4  | 1.7  | 1.1 | 0.8 |
| 15 mil   | 8.9                                     | 7.2  | 5.8  | 4.7  | 3.6  | 2.6  | 1.7 | 1.2 |             | 8.9                                     | 7.2  | 5.8  | 4.7  | 3.6  | 2.6  | 1.7 | 1.2 |
| 20 mil   | 11.9                                    | 9.5  | 7.7  | 6.2  | 4.8  | 3.4  | 2.2 | 1.7 |             | 11.9                                    | 9.5  | 7.7  | 6.2  | 4.8  | 3.4  | 2.2 | 1.7 |
| 30 mil   | 17.8                                    | 14.3 | 11.5 | 9.3  | 7.3  | 5.2  | 3.3 | 2.5 |             | 17.8                                    | 14.3 | 11.5 | 9.3  | 7.3  | 5.2  | 3.3 | 2.5 |
| 40 mil   | 23.8                                    | 19.1 | 15.4 | 12.4 | 9.7  | 6.9  | 4.4 | 3.3 |             | 23.8                                    | 19.1 | 15.4 | 12.4 | 9.7  | 6.9  | 4.4 | 3.3 |
| 2 mil  | 2.5                                     | 2.0  | 1.6  | 1.3  | 1.0  | 0.7  | 0.5 | 0.3 | Narrow Lens | 2.5                                     | 2.0  | 1.6  | 1.3  | 1.0  | 0.7  | 0.5 | 0.3 |
| 2.5 mil  | 3.1                                     | 2.5  | 2.0  | 1.6  | 1.3  | 0.9  | 0.6 | 0.4 |             | 3.1                                     | 2.5  | 2.0  | 1.6  | 1.3  | 0.9  | 0.6 | 0.4 |
| 3.3 mil  | 4.1                                     | 3.3  | 2.6  | 2.1  | 1.7  | 1.2  | 0.8 | 0.6 |             | 4.1                                     | 3.3  | 2.6  | 2.1  | 1.7  | 1.2  | 0.8 | 0.6 |
| 5 mil  | 6.2                                     | 4.9  | 4.0  | 3.2  | 2.5  | 1.8  | 1.1 | 0.9 |             | 6.2                                     | 4.9  | 4.0  | 3.2  | 2.5  | 1.8  | 1.1 | 0.9 |
| 7.5 mil  | 9.2                                     | 7.4  | 6.0  | 4.8  | 3.8  | 2.7  | 1.7 | 1.3 |             | 9.2                                     | 7.4  | 6.0  | 4.8  | 3.8  | 2.7  | 1.7 | 1.3 |
| 10 mil   | 12.3                                    | 9.9  | 8.0  | 6.4  | 5.0  | 3.6  | 2.3 | 1.7 |             | 12.3                                    | 9.9  | 8.0  | 6.4  | 5.0  | 3.6  | 2.3 | 1.7 |
| 15 mil   | 18.5                                    | 14.8 | 12.0 | 9.7  | 7.5  | 5.4  | 3.4 | 2.6 |             | 18.5                                    | 14.8 | 12.0 | 9.7  | 7.5  | 5.4  | 3.4 | 2.6 |
| 20 mil   | 24.7                                    | 19.8 | 16.0 | 12.9 | 10.0 | 7.1  | 4.6 | 3.5 |             | 24.7                                    | 19.8 | 16.0 | 12.9 | 10.0 | 7.1  | 4.6 | 3.5 |
| 30 mil   | 37.0                                    | 29.7 | 24.0 | 19.3 | 15.1 | 10.7 | 6.9 | 5.2 |             | 37.0                                    | 29.7 | 24.0 | 19.3 | 15.1 | 10.7 | 6.9 | 5.2 |
| 40 mil   | 49.3                                    | 39.6 | 31.9 | 25.8 | 20.1 | 14.3 | 9.2 | 6.9 |             | 49.3                                    | 39.6 | 31.9 | 25.8 | 20.1 | 14.3 | 9.2 | 6.9 |

# Readability Table – 1.2 Megapixel

| 1.2 Megapixel – Pixels Per Element / Readability Chart |   |      |      |      |      |      |      |      |      |   |      |      |      |      |      |      |      |
|--|---|------|------|------|------|------|------|------|------|---|------|------|------|------|------|------|------|
| Minimum Element Size                                   | Readability of 1D Code at Distance (mm) |      |      |      |      |      |      |      | Lens | Readability of 2D Code at Distance (mm) |      |      |      |      |      |      |      |
|  | 50                                      | 64   | 81   | 102  | 133  | 190  | 300  | 400  |      | 50                                      | 64   | 81   | 102  | 133  | 190  | 300  | 400  |
| Wide Lens  | 2 mil                                   | 1.2  | 1.0  | 0.8  | 0.6  | 0.5  | 0.4  | 0.2  | 0.2  | 1.2                                     | 1.0  | 0.8  | 0.6  | 0.5  | 0.4  | 0.2  | 0.2  |
|  | 2.5 mil                                 | 1.5  | 1.2  | 1.0  | 0.8  | 0.6  | 0.4  | 0.3  | 0.2  | 1.5                                     | 1.2  | 1.0  | 0.8  | 0.6  | 0.4  | 0.3  | 0.2  |
|  | 3.3 mil                                 | 2.0  | 1.6  | 1.3  | 1.1  | 0.8  | 0.6  | 0.4  | 0.3  | 2.0                                     | 1.6  | 1.3  | 1.1  | 0.8  | 0.6  | 0.4  | 0.3  |
|  | 5 mil                                   | 3.1  | 2.5  | 2.0  | 1.6  | 1.3  | 0.9  | 0.6  | 0.4  | 3.1                                     | 2.5  | 2.0  | 1.6  | 1.3  | 0.9  | 0.6  | 0.4  |
|  | 7.5 mil                                 | 4.6  | 3.7  | 3.0  | 2.4  | 1.9  | 1.3  | 0.9  | 0.6  | 4.6                                     | 3.7  | 3.0  | 2.4  | 1.9  | 1.3  | 0.9  | 0.6  |
|  | 10 mil                                  | 6.2  | 5.0  | 4.0  | 3.2  | 2.5  | 1.8  | 1.1  | 0.9  | 6.2                                     | 5.0  | 4.0  | 3.2  | 2.5  | 1.8  | 1.1  | 0.9  |
|  | 15 mil                                  | 9.3  | 7.4  | 6.0  | 4.8  | 3.8  | 2.7  | 1.7  | 1.3  | 9.3                                     | 7.4  | 6.0  | 4.8  | 3.8  | 2.7  | 1.7  | 1.3  |
|  | 20 mil                                  | 12.4 | 9.9  | 8.0  | 6.5  | 5.0  | 3.6  | 2.3  | 1.7  | 12.4                                    | 9.9  | 8.0  | 6.5  | 5.0  | 3.6  | 2.3  | 1.7  |
|  | 30 mil                                  | 18.5 | 14.9 | 12.0 | 9.7  | 7.5  | 5.4  | 3.4  | 2.6  | 18.5                                    | 14.9 | 12.0 | 9.7  | 7.5  | 5.4  | 3.4  | 2.6  |
|  | 40 mil                                  | 24.7 | 19.8 | 16.0 | 12.9 | 10.1 | 7.2  | 4.6  | 3.5  | 24.7                                    | 19.8 | 16.0 | 12.9 | 10.1 | 7.2  | 4.6  | 3.5  |
| Medium Lens  | 2 mil                                   | 1.8  | 1.4  | 1.2  | 0.9  | 0.7  | 0.5  | 0.3  | 0.2  | 1.8                                     | 1.4  | 1.2  | 0.9  | 0.7  | 0.5  | 0.3  | 0.2  |
|  | 2.5 mil                                 | 2.2  | 1.8  | 1.4  | 1.2  | 0.9  | 0.6  | 0.4  | 0.3  | 2.2                                     | 1.8  | 1.4  | 1.2  | 0.9  | 0.6  | 0.4  | 0.3  |
|  | 3.3 mil                                 | 2.9  | 2.4  | 1.9  | 1.5  | 1.2  | 0.9  | 0.5  | 0.4  | 2.9                                     | 2.4  | 1.9  | 1.5  | 1.2  | 0.9  | 0.5  | 0.4  |
|  | 5 mil                                   | 4.5  | 3.6  | 2.9  | 2.3  | 1.8  | 1.3  | 0.8  | 0.6  | 4.5                                     | 3.6  | 2.9  | 2.3  | 1.8  | 1.3  | 0.8  | 0.6  |
|  | 7.5 mil                                 | 6.7  | 5.4  | 4.3  | 3.5  | 2.7  | 1.9  | 1.2  | 0.9  | 6.7                                     | 5.4  | 4.3  | 3.5  | 2.7  | 1.9  | 1.2  | 0.9  |
|  | 10 mil                                  | 8.9  | 7.2  | 5.8  | 4.7  | 3.6  | 2.6  | 1.7  | 1.2  | 8.9                                     | 7.2  | 5.8  | 4.7  | 3.6  | 2.6  | 1.7  | 1.2  |
|  | 15 mil                                  | 13.4 | 10.7 | 8.7  | 7.0  | 5.4  | 3.9  | 2.5  | 1.9  | 13.4                                    | 10.7 | 8.7  | 7.0  | 5.4  | 3.9  | 2.5  | 1.9  |
|  | 20 mil                                  | 17.8 | 14.3 | 11.5 | 9.3  | 7.3  | 5.2  | 3.3  | 2.5  | 17.8                                    | 14.3 | 11.5 | 9.3  | 7.3  | 5.2  | 3.3  | 2.5  |
|  | 30 mil                                  | 26.7 | 21.5 | 17.3 | 14.0 | 10.9 | 7.7  | 5.0  | 3.7  | 26.7                                    | 21.5 | 17.3 | 14.0 | 10.9 | 7.7  | 5.0  | 3.7  |
|  | 40 mil                                  | 35.6 | 28.6 | 23.1 | 18.6 | 14.5 | 10.3 | 6.6  | 5.0  | 35.6                                    | 28.6 | 23.1 | 18.6 | 14.5 | 10.3 | 6.6  | 5.0  |
| Narrow Lens  | 2 mil                                   | 3.9  | 3.2  | 2.6  | 2.1  | 1.6  | 1.1  | 0.7  | 0.6  | 3.9                                     | 3.2  | 2.6  | 2.1  | 1.6  | 1.1  | 0.7  | 0.6  |
|  | 2.5 mil                                 | 4.9  | 4.0  | 3.2  | 2.6  | 2.0  | 1.4  | 0.9  | 0.7  | 4.9                                     | 4.0  | 3.2  | 2.6  | 2.0  | 1.4  | 0.9  | 0.7  |
|  | 3.3 mil                                 | 6.5  | 5.2  | 4.2  | 3.4  | 2.7  | 1.9  | 1.2  | 0.9  | 6.5                                     | 5.2  | 4.2  | 3.4  | 2.7  | 1.9  | 1.2  | 0.9  |
|  | 5 mil                                   | 9.9  | 7.9  | 6.4  | 5.2  | 4.0  | 2.9  | 1.8  | 1.4  | 9.9                                     | 7.9  | 6.4  | 5.2  | 4.0  | 2.9  | 1.8  | 1.4  |
|  | 7.5 mil                                 | 14.8 | 11.9 | 9.6  | 7.7  | 6.0  | 4.3  | 2.7  | 2.1  | 14.8                                    | 11.9 | 9.6  | 7.7  | 6.0  | 4.3  | 2.7  | 2.1  |
|  | 10 mil                                  | 19.7 | 15.8 | 12.8 | 10.3 | 8.0  | 5.7  | 3.7  | 2.8  | 19.7                                    | 15.8 | 12.8 | 10.3 | 8.0  | 5.7  | 3.7  | 2.8  |
|  | 15 mil                                  | 29.6 | 23.8 | 19.2 | 15.5 | 12.0 | 8.6  | 5.5  | 4.1  | 29.6                                    | 23.8 | 19.2 | 15.5 | 12.0 | 8.6  | 5.5  | 4.1  |
|  | 20 mil                                  | 39.5 | 31.7 | 25.6 | 20.6 | 16.1 | 11.4 | 7.3  | 5.5  | 39.5                                    | 31.7 | 25.6 | 20.6 | 16.1 | 11.4 | 7.3  | 5.5  |
|  | 30 mil                                  | 59.2 | 47.5 | 38.3 | 30.9 | 24.1 | 17.1 | 11.0 | 8.3  | 59.2                                    | 47.5 | 38.3 | 30.9 | 24.1 | 17.1 | 11.0 | 8.3  |
|  | 40 mil                                  | 78.9 | 63.3 | 51.1 | 41.3 | 32.1 | 22.8 | 14.6 | 11.1 | 78.9                                    | 63.3 | 51.1 | 41.3 | 32.1 | 22.8 | 14.6 | 11.1 |

## Readability Table – 5 Megapixel

| 5 Megapixel – Pixels Per Element / Readability Chart |   |      |      |      |      |      |      |      |             |   |      |      |      |      |      |      |      |
|--|---|------|------|------|------|------|------|------|-------------|---|------|------|------|------|------|------|------|
| Minimum Element Size                                 | Readability of 1D Code at Distance (mm) |      |      |      |      |      |      |      | Lens        | Readability of 2D Code at Distance (mm) |      |      |      |      |      |      |      |
|  | 50                                      | 64   | 81   | 102  | 133  | 190  | 300  | 400  |             | 50                                      | 64   | 81   | 102  | 133  | 190  | 300  | 400  |
| 2 mil  | 1.7                                     | 1.4  | 1.1  | 0.9  | 0.7  | 0.5  | 0.3  | 0.2  | Wide Lens   | 1.7                                     | 1.4  | 1.1  | 0.9  | 0.7  | 0.5  | 0.3  | 0.2  |
| 2.5 mil  | 2.2                                     | 1.7  | 1.4  | 1.1  | 0.9  | 0.6  | 0.4  | 0.3  |             | 2.2                                     | 1.7  | 1.4  | 1.1  | 0.9  | 0.6  | 0.4  | 0.3  |
| 3.3 mil  | 2.8                                     | 2.3  | 1.8  | 1.5  | 1.2  | 0.8  | 0.5  | 0.4  |             | 2.8                                     | 2.3  | 1.8  | 1.5  | 1.2  | 0.8  | 0.5  | 0.4  |
| 5 mil  | 4.3                                     | 3.5  | 2.8  | 2.3  | 1.8  | 1.2  | 0.8  | 0.6  |             | 4.3                                     | 3.5  | 2.8  | 2.3  | 1.8  | 1.2  | 0.8  | 0.6  |
| 7.5 mil  | 6.5                                     | 5.2  | 4.2  | 3.4  | 2.6  | 1.9  | 1.2  | 0.9  |             | 6.5                                     | 5.2  | 4.2  | 3.4  | 2.6  | 1.9  | 1.2  | 0.9  |
| 10 mil   | 8.6                                     | 6.9  | 5.6  | 4.5  | 3.5  | 2.5  | 1.6  | 1.2  |             | 8.6                                     | 6.9  | 5.6  | 4.5  | 3.5  | 2.5  | 1.6  | 1.2  |
| 15 mil   | 12.9                                    | 10.4 | 8.4  | 6.8  | 5.3  | 3.7  | 2.4  | 1.8  |             | 12.9                                    | 10.4 | 8.4  | 6.8  | 5.3  | 3.7  | 2.4  | 1.8  |
| 20 mil   | 17.3                                    | 13.9 | 11.2 | 9.0  | 7.0  | 5.0  | 3.2  | 2.4  |             | 17.3                                    | 13.9 | 11.2 | 9.0  | 7.0  | 5.0  | 3.2  | 2.4  |
| 30 mil   | 25.9                                    | 20.8 | 16.8 | 13.5 | 10.5 | 7.5  | 4.8  | 3.6  |             | 25.9                                    | 20.8 | 16.8 | 13.5 | 10.5 | 7.5  | 4.8  | 3.6  |
| 40 mil   | 34.5                                    | 27.7 | 22.4 | 18.1 | 14.1 | 10.0 | 6.4  | 4.8  |             | 34.5                                    | 27.7 | 22.4 | 18.1 | 14.1 | 10.0 | 6.4  | 4.8  |
| 2 mil  | 2.5                                     | 2.0  | 1.6  | 1.3  | 1.0  | 0.7  | 0.5  | 0.3  | Medium Lens | 2.5                                     | 2.0  | 1.6  | 1.3  | 1.0  | 0.7  | 0.5  | 0.3  |
| 2.5 mil  | 3.1                                     | 2.5  | 2.0  | 1.6  | 1.3  | 0.9  | 0.6  | 0.4  |             | 3.1                                     | 2.5  | 2.0  | 1.6  | 1.3  | 0.9  | 0.6  | 0.4  |
| 3.3 mil  | 4.1                                     | 3.3  | 2.7  | 2.1  | 1.7  | 1.2  | 0.8  | 0.6  |             | 4.1                                     | 3.3  | 2.7  | 2.1  | 1.7  | 1.2  | 0.8  | 0.6  |
| 5 mil  | 6.2                                     | 5.0  | 4.0  | 3.3  | 2.5  | 1.8  | 1.2  | 0.9  |             | 6.2                                     | 5.0  | 4.0  | 3.3  | 2.5  | 1.8  | 1.2  | 0.9  |
| 7.5 mil  | 9.3                                     | 7.5  | 6.0  | 4.9  | 3.8  | 2.7  | 1.7  | 1.3  |             | 9.3                                     | 7.5  | 6.0  | 4.9  | 3.8  | 2.7  | 1.7  | 1.3  |
| 10 mil   | 12.5                                    | 10.0 | 8.1  | 6.5  | 5.1  | 3.6  | 2.3  | 1.7  |             | 12.5                                    | 10.0 | 8.1  | 6.5  | 5.1  | 3.6  | 2.3  | 1.7  |
| 15 mil   | 18.7                                    | 15.0 | 12.1 | 9.8  | 7.6  | 5.4  | 3.5  | 2.6  |             | 18.7                                    | 15.0 | 12.1 | 9.8  | 7.6  | 5.4  | 3.5  | 2.6  |
| 20 mil   | 24.9                                    | 20.0 | 16.1 | 13.0 | 10.1 | 7.2  | 4.6  | 3.5  |             | 24.9                                    | 20.0 | 16.1 | 13.0 | 10.1 | 7.2  | 4.6  | 3.5  |
| 30 mil   | 37.4                                    | 30.0 | 24.2 | 19.5 | 15.2 | 10.8 | 6.9  | 5.2  |             | 37.4                                    | 30.0 | 24.2 | 19.5 | 15.2 | 10.8 | 6.9  | 5.2  |
| 40 mil   | 49.8                                    | 40.0 | 32.3 | 26.0 | 20.3 | 14.4 | 9.2  | 7.0  |             | 49.8                                    | 40.0 | 32.3 | 26.0 | 20.3 | 14.4 | 9.2  | 7.0  |
| 2 mil  | 5.5                                     | 4.4  | 3.6  | 2.9  | 2.2  | 1.6  | 1.0  | 0.8  | Narrow Lens | 5.5                                     | 4.4  | 3.6  | 2.9  | 2.2  | 1.6  | 1.0  | 0.8  |
| 2.5 mil  | 6.9                                     | 5.5  | 4.5  | 3.6  | 2.8  | 2.0  | 1.3  | 1.0  |             | 6.9                                     | 5.5  | 4.5  | 3.6  | 2.8  | 2.0  | 1.3  | 1.0  |
| 3.3 mil  | 9.1                                     | 7.3  | 5.9  | 4.8  | 3.7  | 2.6  | 1.7  | 1.3  |             | 9.1                                     | 7.3  | 5.9  | 4.8  | 3.7  | 2.6  | 1.7  | 1.3  |
| 5 mil  | 13.8                                    | 11.1 | 8.9  | 7.2  | 5.6  | 4.0  | 2.6  | 1.9  |             | 13.8                                    | 11.1 | 8.9  | 7.2  | 5.6  | 4.0  | 2.6  | 1.9  |
| 7.5 mil  | 20.7                                    | 16.6 | 13.4 | 10.8 | 8.4  | 6.0  | 3.8  | 2.9  |             | 20.7                                    | 16.6 | 13.4 | 10.8 | 8.4  | 6.0  | 3.8  | 2.9  |
| 10 mil   | 27.6                                    | 22.1 | 17.8 | 14.4 | 11.2 | 8.0  | 5.1  | 3.9  |             | 27.6                                    | 22.1 | 17.8 | 14.4 | 11.2 | 8.0  | 5.1  | 3.9  |
| 15 mil   | 41.3                                    | 33.2 | 26.8 | 21.6 | 16.8 | 12.0 | 7.7  | 5.8  |             | 41.3                                    | 33.2 | 26.8 | 21.6 | 16.8 | 12.0 | 7.7  | 5.8  |
| 20 mil   | 55.1                                    | 44.2 | 35.7 | 28.8 | 22.4 | 15.9 | 10.2 | 7.7  |             | 55.1                                    | 44.2 | 35.7 | 28.8 | 22.4 | 15.9 | 10.2 | 7.7  |
| 30 mil   | 82.7                                    | 66.4 | 53.5 | 43.2 | 33.7 | 23.9 | 15.3 | 11.6 |             | 82.7                                    | 66.4 | 53.5 | 43.2 | 33.7 | 23.9 | 15.3 | 11.6 |
| 40 mil   | 110.2                                   | 88.5 | 71.4 | 57.6 | 44.9 | 31.9 | 20.5 | 15.4 |             | 110.2                                   | 88.5 | 71.4 | 57.6 | 44.9 | 31.9 | 20.5 | 15.4 |

## Readability Table – Long Range

Long Range readability is shown out to 1,500 even though Autofocus is only specified out to 1,160. At the longest focus distance, the lens has a very deep depth of field. Large codes can actually be read beyond 2,000 mm.

| Long Range 1.2 MP - Pixels Per Element/Readability Chart |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |
|--|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|
| Readability of 1D Code at Distance (mm)                  |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |
| Min Element Size   | 100   | 200   | 300   | 400   | 500  | 600  | 700  | 800  | 900  | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 |
| 2 mil  | 2.10  | 1.09  | 0.73  | 0.55  | 0.44 | 0.37 | 0.32 | 0.28 | 0.25 | 0.22 | 0.20 | 0.19 | 0.17 | 0.16 | 0.15 |
| 2.5 mil  | 2.63  | 1.36  | 0.92  | 0.69  | 0.55 | 0.46 | 0.40 | 0.35 | 0.31 | 0.28 | 0.25 | 0.23 | 0.22 | 0.20 | 0.19 |
| 3.3 mil  | 3.47  | 1.79  | 1.21  | 0.91  | 0.73 | 0.61 | 0.52 | 0.46 | 0.41 | 0.37 | 0.34 | 0.31 | 0.28 | 0.26 | 0.25 |
| 5 mil  | 5.25  | 2.72  | 1.83  | 1.38  | 1.11 | 0.93 | 0.80 | 0.70 | 0.62 | 0.56 | 0.51 | 0.47 | 0.43 | 0.40 | 0.37 |
| 7.5 mil  | 7.88  | 4.07  | 2.75  | 2.07  | 1.66 | 1.39 | 1.19 | 1.04 | 0.93 | 0.84 | 0.76 | 0.70 | 0.65 | 0.60 | 0.56 |
| 10 mil   | 10.51 | 5.43  | 3.66  | 2.76  | 2.22 | 1.85 | 1.59 | 1.39 | 1.24 | 1.12 | 1.02 | 0.93 | 0.86 | 0.80 | 0.75 |
| 15 mil   | 15.76 | 8.15  | 5.49  | 4.14  | 3.33 | 2.78 | 2.39 | 2.09 | 1.86 | 1.67 | 1.52 | 1.40 | 1.29 | 1.20 | 1.12 |
| 20 mil   | 21.02 | 10.86 | 7.32  | 5.53  | 4.44 | 3.70 | 3.18 | 2.79 | 2.48 | 2.23 | 2.03 | 1.86 | 1.72 | 1.60 | 1.49 |
| 30 mil   | 31.52 | 16.30 | 10.99 | 8.29  | 6.65 | 5.56 | 4.77 | 4.18 | 3.72 | 3.35 | 3.05 | 2.79 | 2.58 | 2.40 | 2.24 |
| 40 mil   | 42.03 | 21.73 | 14.65 | 11.05 | 8.87 | 7.41 | 6.36 | 5.57 | 4.96 | 4.47 | 4.06 | 3.73 | 3.44 | 3.20 | 2.98 |

| Readability of 2D Code at Distance (mm) |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |
|---|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|
| Min Element Size                        | 100   | 200   | 300   | 400   | 500  | 600  | 700  | 800  | 900  | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 |
| 2 mil                                   | 2.10  | 1.09  | 0.73  | 0.55  | 0.44 | 0.37 | 0.32 | 0.28 | 0.25 | 0.22 | 0.20 | 0.19 | 0.17 | 0.16 | 0.15 |
| 2.5 mil                                 | 2.63  | 1.36  | 0.92  | 0.69  | 0.55 | 0.46 | 0.40 | 0.35 | 0.31 | 0.28 | 0.25 | 0.23 | 0.22 | 0.20 | 0.19 |
| 3.3 mil                                 | 3.47  | 1.79  | 1.21  | 0.91  | 0.73 | 0.61 | 0.52 | 0.46 | 0.41 | 0.37 | 0.34 | 0.31 | 0.28 | 0.26 | 0.25 |
| 5 mil                                   | 5.25  | 2.72  | 1.83  | 1.38  | 1.11 | 0.93 | 0.80 | 0.70 | 0.62 | 0.56 | 0.51 | 0.47 | 0.43 | 0.40 | 0.37 |
| 7.5 mil                                 | 7.88  | 4.07  | 2.75  | 2.07  | 1.66 | 1.39 | 1.19 | 1.04 | 0.93 | 0.84 | 0.76 | 0.70 | 0.65 | 0.60 | 0.56 |
| 10 mil                                  | 10.51 | 5.43  | 3.66  | 2.76  | 2.22 | 1.85 | 1.59 | 1.39 | 1.24 | 1.12 | 1.02 | 0.93 | 0.86 | 0.80 | 0.75 |
| 15 mil                                  | 15.76 | 8.15  | 5.49  | 4.14  | 3.33 | 2.78 | 2.39 | 2.09 | 1.86 | 1.67 | 1.52 | 1.40 | 1.29 | 1.20 | 1.12 |
| 20 mil                                  | 21.02 | 10.86 | 7.32  | 5.53  | 4.44 | 3.70 | 3.18 | 2.79 | 2.48 | 2.23 | 2.03 | 1.86 | 1.72 | 1.60 | 1.49 |
| 30 mil                                  | 31.52 | 16.30 | 10.99 | 8.29  | 6.65 | 5.56 | 4.77 | 4.18 | 3.72 | 3.35 | 3.05 | 2.79 | 2.58 | 2.40 | 2.24 |
| 40 mil                                  | 42.03 | 21.73 | 14.65 | 11.05 | 8.87 | 7.41 | 6.36 | 5.57 | 4.96 | 4.47 | 4.06 | 3.73 | 3.44 | 3.20 | 2.98 |

## Ratings and Specifications

| V420-F                     |   | V420-F□□□□03M-□□□□  | V420-F□□□□12M-□□□□         | V420-F□□□□50C-□□□□  |
|----------------------------|---|---|----------------------------|---------------------|
| Symbologies *1             | 1D Symbologies  | Code 39, Code 128, BC412, Interleaved 2 of 5, UPC/EAN, Codabar, Code 93, Pharmacode, PLANET, Postnet, Japanese Post, Australian Post, Royal Mail, Intelligent Mail, KIX |                            |                     |
|                            | 2D Symbologies  | Data Matrix (ECC 0-200), QR Code, Micro QR Code, Aztec Code, DotCode  |                            |                     |
|                            | Stacked Symbologies   | PDF417, MicroPDF417, GS1 Databar (Composite and Stacked)  |                            |                     |
| Reading Performance *2     | Number of Reading Digits  | No Upper Limit (depending on bar width and reading distance)  |                            |                     |
|                            | Aiming Light  | Two Blue LEDs   |                            |                     |
|                            | Illumination  | Inner LEDs: Four White and Four Red (Wavelength: 625 nm)  |                            |                     |
|                            |   | Outer LEDs: 8 Red or White  | Outer LEDs: 8 Red or White | Outer LEDs: 8 White |
|                            | Reading Distance / Field of View  | Refer to <i>Field of View Charts</i> for details.   |                            |                     |
|                            | Pitch Angle ( $\alpha$ ) *3   | $\pm 30^\circ$  |                            |                     |
|                            | Skew Angle ( $\beta$ ) *3   | $\pm 30^\circ$  |                            |                     |
| Tilt Angle ( $\gamma$ ) *3 | $\pm 180^\circ$   |   |                            |                     |
| Image Capture              | Focus   | Liquid Lens Autofocus or Fixed Focus (Wide = 5.2 mm, Medium = 7.7 mm, Narrow = 16 mm, L = 16 mm)  |                            |                     |
|                            | Resolution  | 752 (H) x 480 (V)   | 1280 (H) x 960 (V)         | 2592 (H) x 1944 (V) |
|                            | Color / Monochrome  | Monochrome CMOS   | Monochrome CMOS            | Color CMOS          |
|                            | Shutter   | Global Shutter  | Global Shutter             | Rolling Shutter     |
|                            | Frames per Second   | 60 fps  | 42 fps                     | 5 fps               |
|                            | Exposure  | 50 to 100,000 $\mu$ s   |                            |                     |
| Image Logging              | FTP   |   |                            |                     |
| Trigger                    | External Trigger (Edge or Level), Communication Trigger (Ethernet, RS-232C)                                     |   |                            |                     |
| I/O Specifications         | Input Signals   | Trigger Input: 5-28 V rated (0.16 mA @ 5V DC); New Master: 5 to 28 V rated (0.16 mA @ 5 VDC); Default: 3.3 V rated (0 mA @ 3.3 V)                                       |                            |                     |
|                            | Output Signals  | 3 Signals : 5 V TTL-compatible, can sink 10 mA and source 10 mA   |                            |                     |
| Communication              | Connectivity  | RS-232C, USB 2.0 High Speed, Ethernet over USB/HID  |                            |                     |
|                            | Ethernet Specifications   | 100BASE-TX / 10BASE-T   |                            |                     |
| Indicator LEDs             | PASS (Green), TRIG (Amber), MODE (Amber), LINK (Amber), FAIL (Red), PWR (Green)                                 |   |                            |                     |
| Power Supply Voltage       | 5 VDC +/- 5%  |   |                            |                     |
| Current Consumption        | 650 mA at 5 VDC (max.)  |   |                            |                     |
| Environmental Immunity *4  | Ambient Temperature Range   | Operating: 0 to 45° C Storage: -50 to 75° C (No Icing or Condensation)  |                            |                     |
|                            | Ambient Humidity Range  | Operating and storage: 5% to 95% (Non-Condensing)   |                            |                     |
|                            | Ambient Atmosphere  | No Corrosive Gases  |                            |                     |
|                            | Vibration Resistance (Destructive)  | Sine Vibration: 10 Hz to 55 Hz, 0.35 mm displacement, 20 cycles/axis. Random Vibration: 20 Hz to 2000 Hz, 6.295 Grms, 30 min/axis                                       |                            |                     |
|                            | Shock Resistance (Destructive)  | 50G, 11 ms, sawtooth profile. 3X in each X, Y, Z axis   |                            |                     |
|                            | Degree of Protection  | IEC 60529 IP54  |                            |                     |
| Weight                     | Main Body Only  | 120 g   |                            |                     |
|                            | Packaging Weight  | Approx. 230 g (including packing)   |                            |                     |
| Dimensions                 | Main Body Dimensions  | 44.5 (W) x 38.1 (D) x 25.4 (H) mm   |                            |                     |
|                            | Packaging Dimensions  | 170 (W) x 117 (D) x 86 (H) mm   |                            |                     |
| Accessories                | ReadMeFirst, CE Compliance Sheet  |   |                            |                     |
| LED Safety Standard        | IEC 62471-1: 2006 Risk-Exempt Group   |   |                            |                     |
| Safety Standards           | EN 55024:2010, EN 55032:2015 + AC:2016<br>FCC Part 15, Subpart B (Class B) UL60950-1<br>BIS, RCM, KC, EAC, BSMI |   |                            |                     |
| Materials                  | Case  | Aluminum Diecast, Alumite (Black)   |                            |                     |
|                            | Reading Window  | Acrylic   |                            |                     |
| Software                   | WebLink   |   |                            |                     |

\*1. These symbologies are supported based on Omron's read capability validation standard. Omron recommends that validation be performed for each application.

\*2. Unless otherwise specified, reading performance is defined with center of field of view, angle  $R = \infty$ .

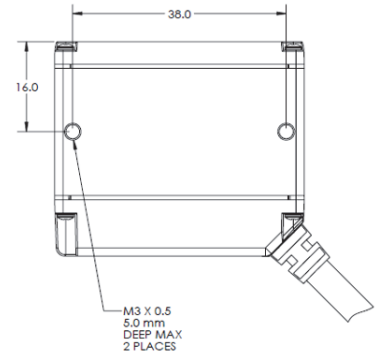
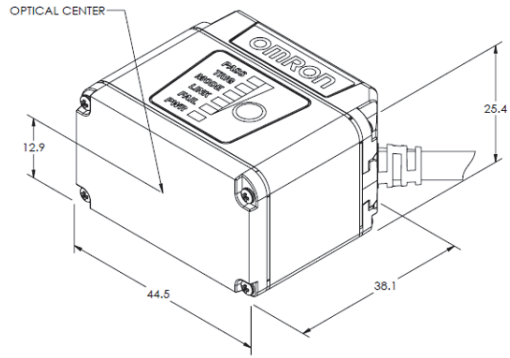


\*4. In an electrically noisy environment, use only the V430-F in combination with a noise filter cable (V430-W□F-□M) to ensure proper operation.

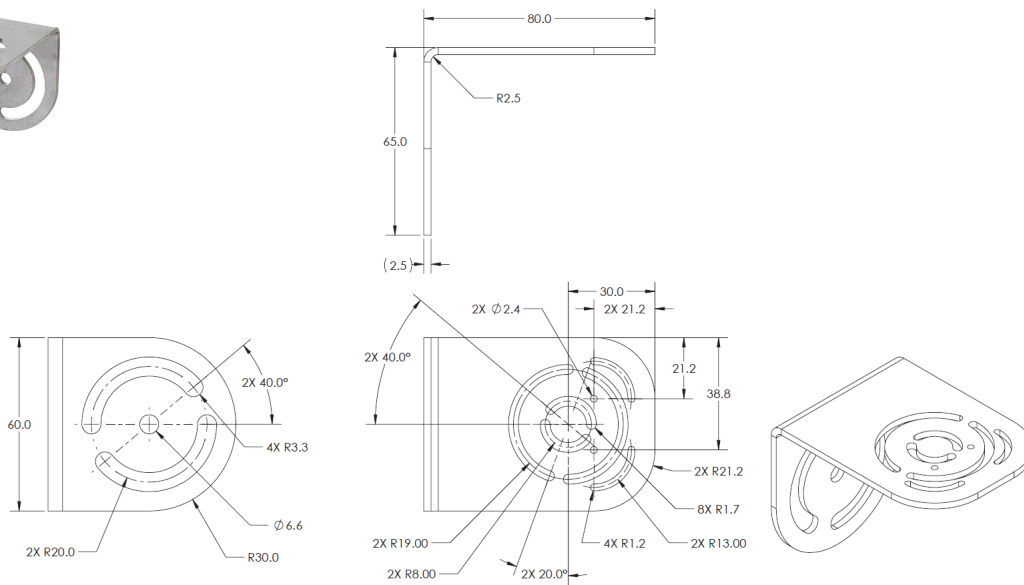
# V420-F

## Dimensions

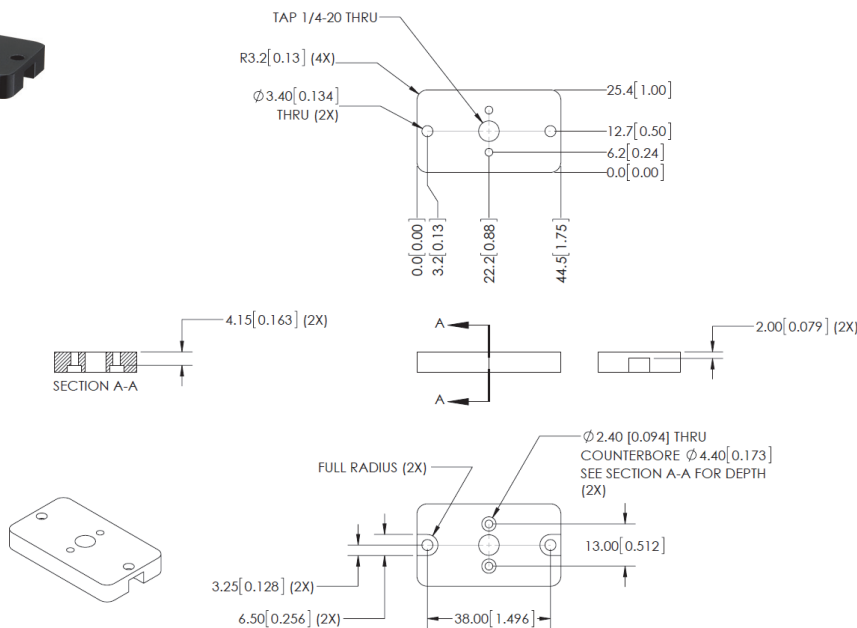
(Unit: mm)



### L Bracket Adjustable Angle Mounting Kit V430-AM0

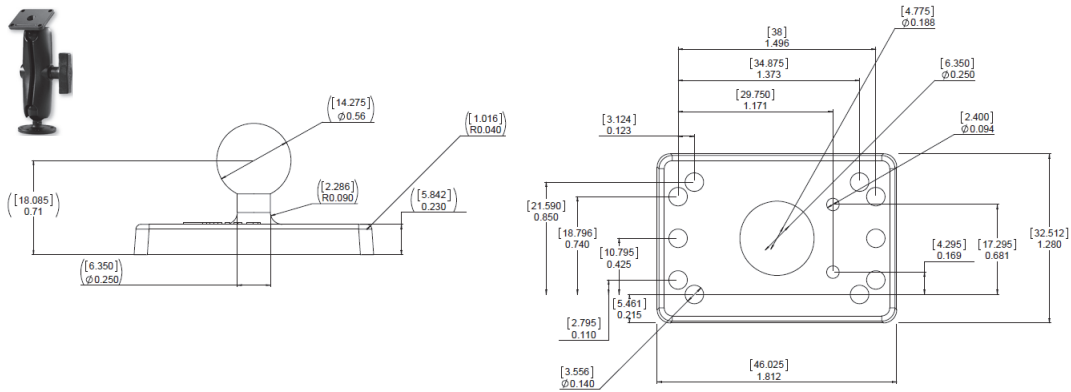


### 1/4-20 Camera Mounting Block Kit V430-AM1

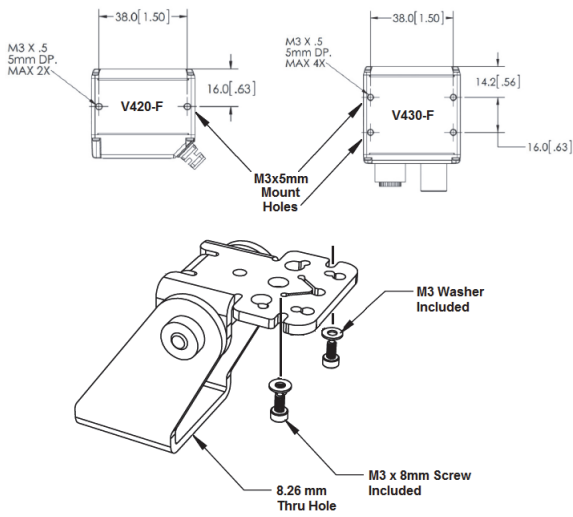




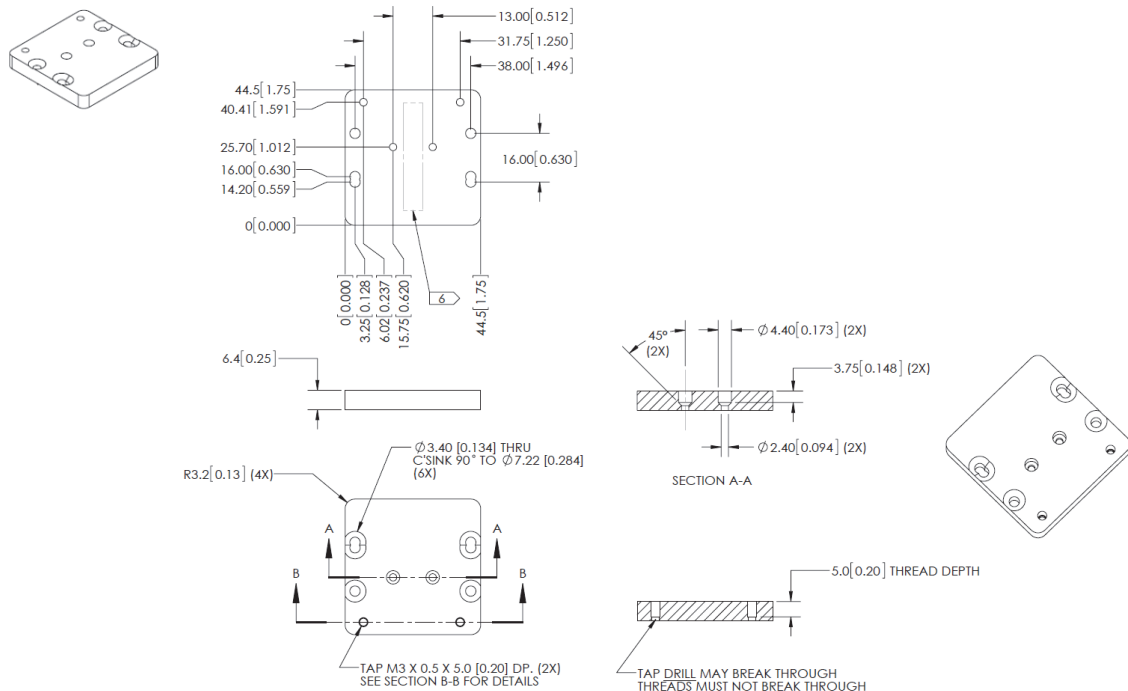
4" (102 mm) Ram Mount Stand  
V430-AM2



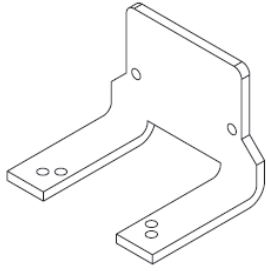
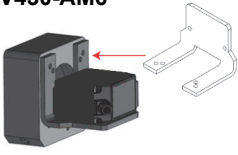
APG Pan and Tilt Camera Mount  
V430-AM3



MS-4 / MINI to V/F4XX-F Adapter Plate  
V430-AM5



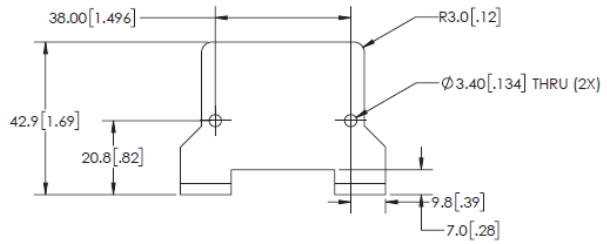
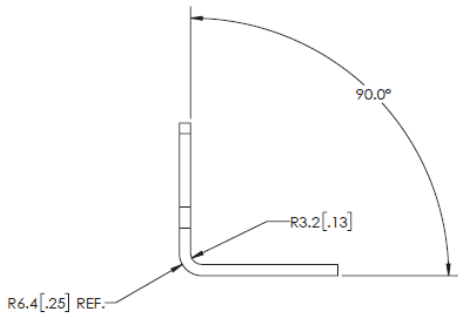
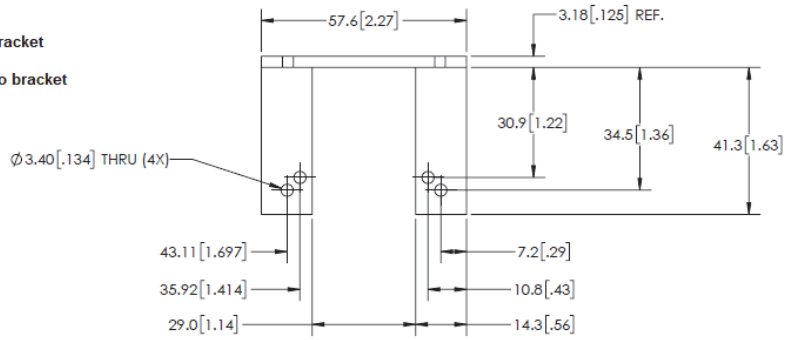
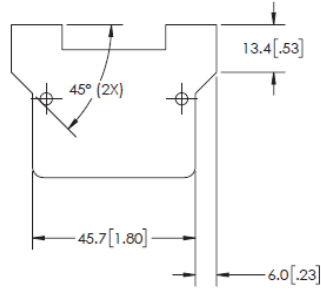
## Smart Ring Light to V/F4XX-F Mounting Bracket V430-AM6



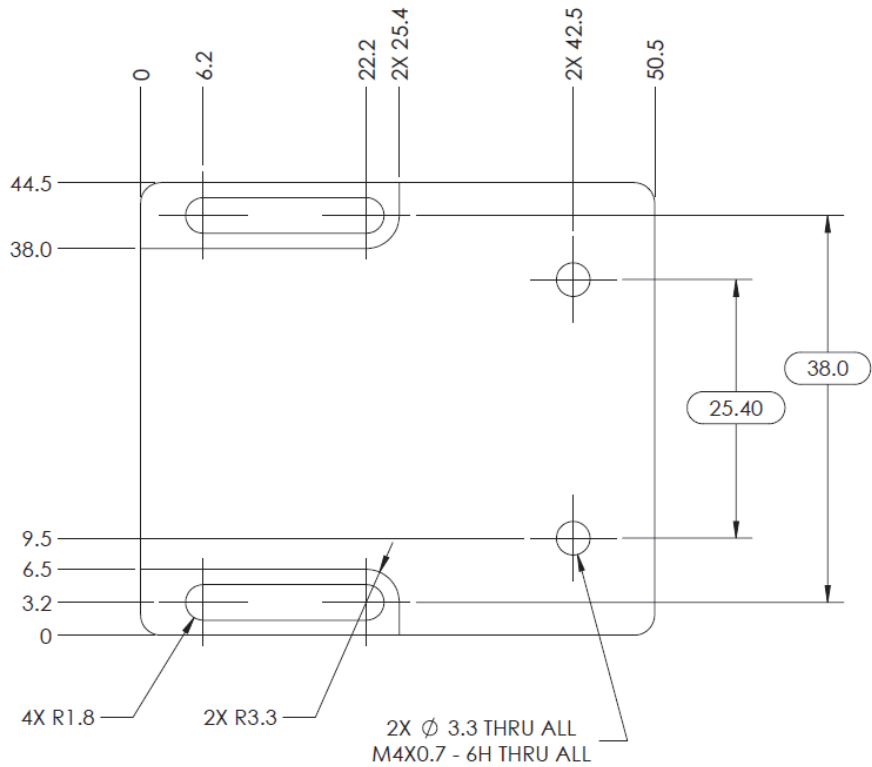
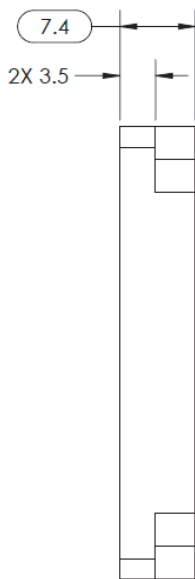
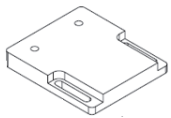
Screws required:

2 M3x6 mm screws to mount light to bracket

2 M3x6 mm screws to mount camera to bracket



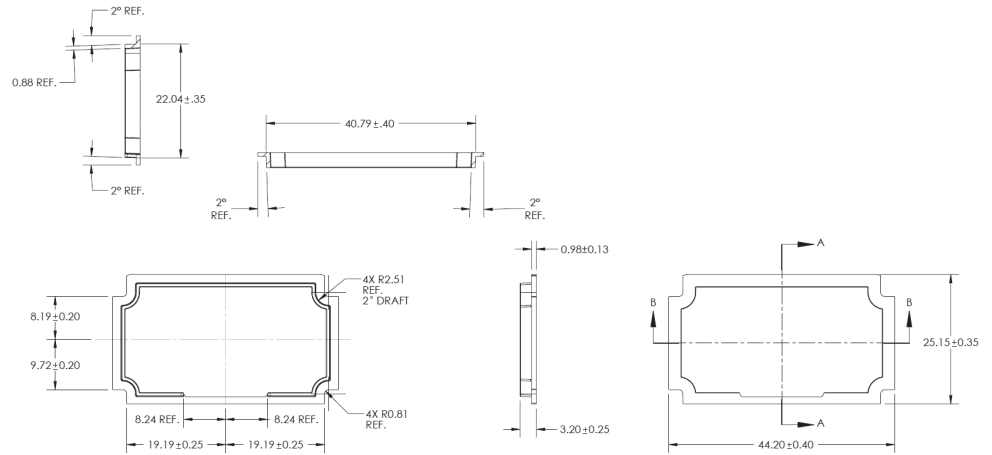
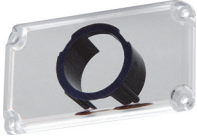
## QX / Vision HAWK to V/F4XX-F Adapter Plate V430-AM7



**Front Window Installation Kit  
V430-AF10 \***

**Diffuser Installation Kit  
V430-AF11 \***

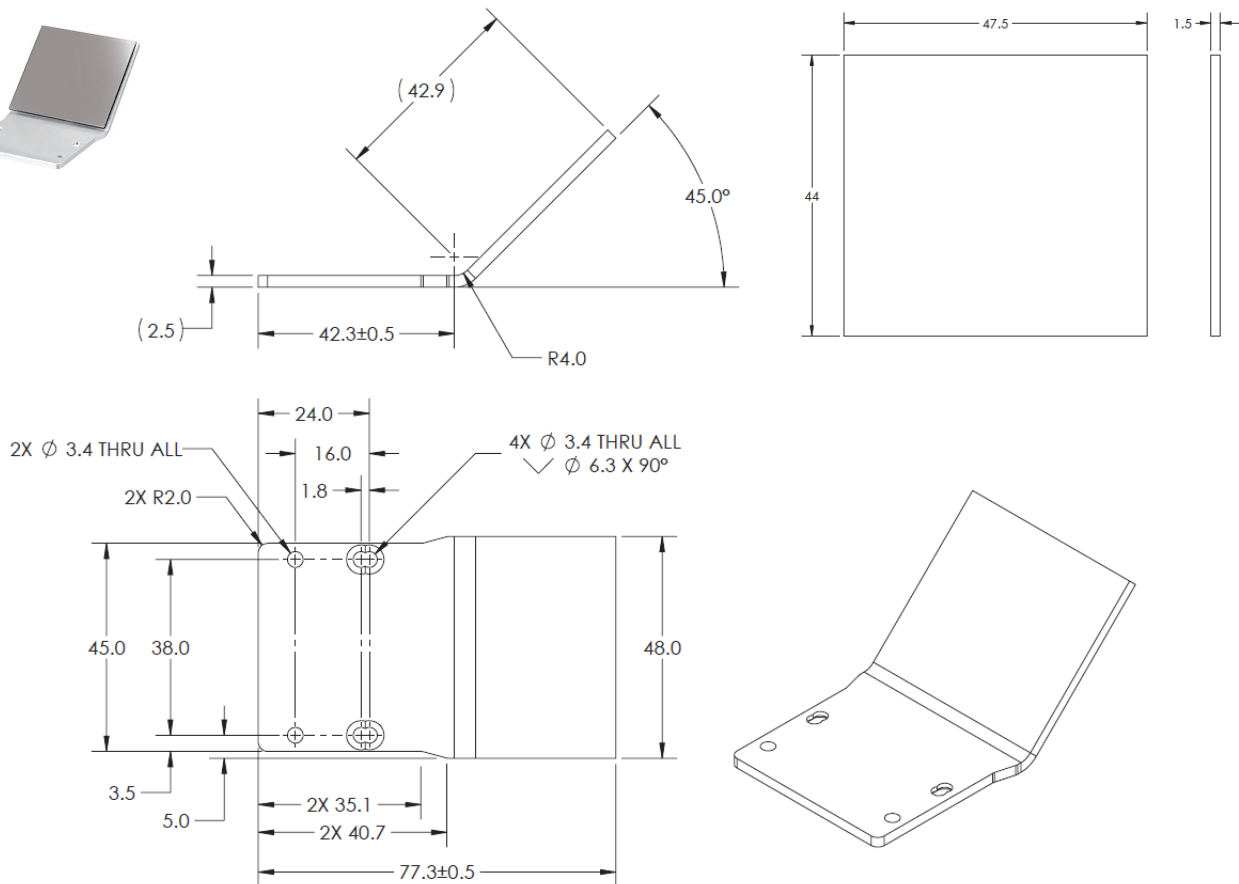
**Polarizer Installation Kit  
V430-AF12 \***



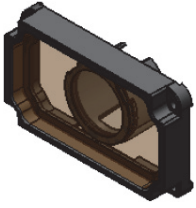
\* **Note:** V430-AF10, AF11, and AF12 are used for **MicroHAWK V/F4X0-FXXXXXXX-XXX** cameras in this manual. The prior generation **MicroHAWK V430-FXXXXXXX** code camera uses part numbers V430-AF0, AF1, and AF2. Please select the correct accessory from the table based on your camera part number format.

| Accessory                     | Prior V430-FXXXXXXX Code Reader | New V/F4X0-FXXXXXXX-XXX Code Reader and Smart Camera |
|-------------------------------|---------------------------------|--|
| Front Window Installation Kit | V430-AF0                        | V430-AF10  |
| Diffuser Installation Kit     | V430-AF1                        | V430-AF11  |
| Polarizer Installation Kit    | V430-AF2                        | V430-AF12  |

**Right Angle Mirror Installation Kit  
V430-AF3**



## YAG Laser Filter Window V430-AF4



### Window Material

Polymer

### Laser Type

Argon  
Broadband  
KTP  
Nd:YAG

### Protection

OD 6+ @ 200-532 nm  
OD 4+ @ 850-879 nm  
OD 5+ @ 900-1070 nm

The V430-AF4 YAG Laser Filter is used to block a range of wavelengths from a variety of laser types from being seen by the MicroHAWK camera that will either disrupt the camera's view of the object, or damage the MicroHAWK sensor.

The table shows the laser types that are handled by the V430-AF4 Filter window, as well as the level of protection they provide at the various wavelengths.

**Note:** Optical Density (OD) is a measure of the attenuation of energy passing through a filter. The higher the OD value, the higher the attenuation and the greater the protection level.

OD 4 blocks 99.99% of the laser energy.

OD 5 blocks 99.999% of the laser energy (YAG).

OD 6 blocks 99.9999% of the laser energy (Argon, KTP)

## ESD-Safe Window V430-AF5

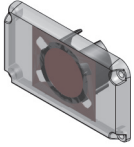


An ESD event occurs when an electrostatic charge rapidly transfers between two objects. This transfer is usually caused when two objects with a notable potential difference in electrical charge contact each other. However, ESD events can also happen when two objects close to one another create a highly charged electrostatic field.

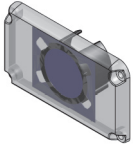
ESD safety precautions are extremely important in the electronics and semiconductor industries where sensitive components can be damaged even by a discharge of a mere 20 volts. Less sensitive components may still be susceptible, and cumulative discharges can create long-term problems affecting the functionality and performance of electronic components.

The MicroHAWK V430-AF5 ESD-Safe window is designed with an ESD coating on the exterior surface to prevent static discharge between the camera or smart camera when the camera is deployed close to the component surface. The antistatic coating offers a resistivity of  $\leq 1.0 \times 10^9 \Omega/\text{sq}$  to prevent these electrostatic discharges.

**Red Filter Installation Kit  
V430-AF6**



**Blue Filter Installation Kit  
V430-AF7**

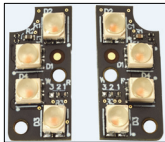


**Red Light Installation Kit  
V430-ALR**

**White Light Installation Kit  
V430-ALW**

**Blue Light Installation Kit  
V430-ALB**

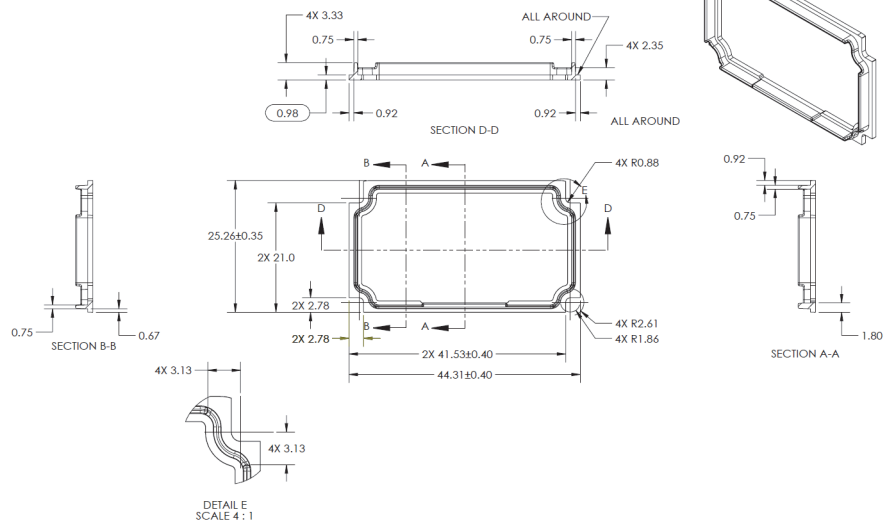
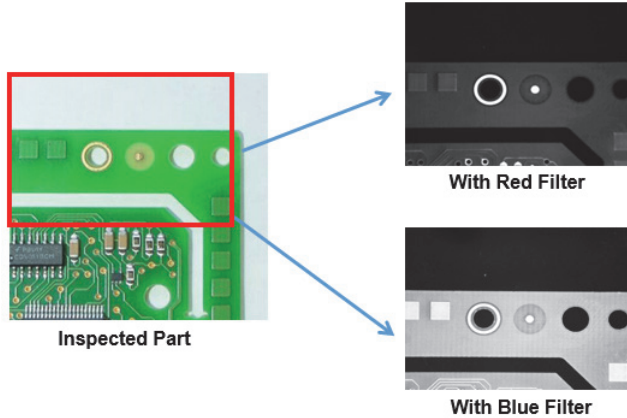
**IR Light Installation Kit  
V430-ALI**



**Red Filter (V430-AF6) and Blue Filter (V430-AF7)**

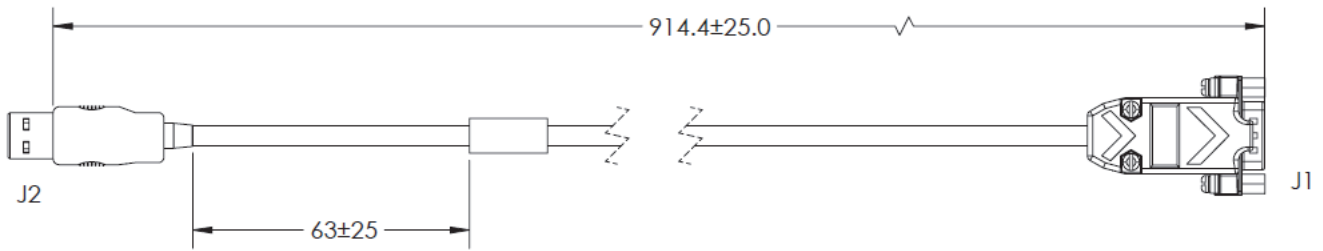
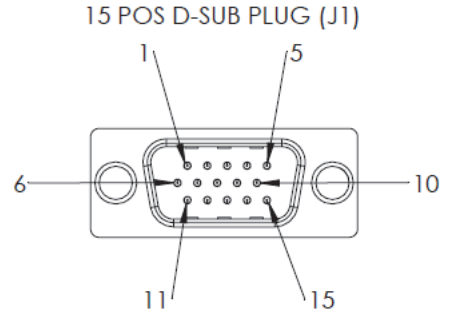
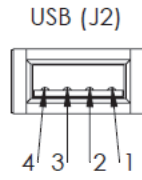
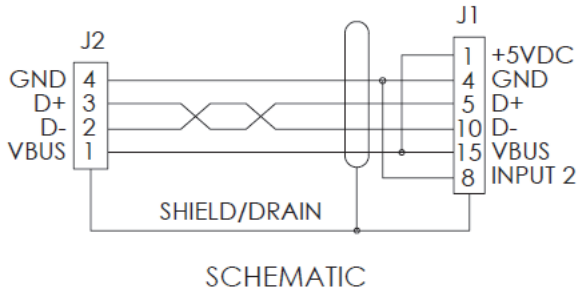
The Red Filter (V430-AF6), and Blue Filter (V430-AF7) are used to turn MicroHAWKS equipped with white lights into units that emit red or blue light. MicroHAWK light color changes can be also be accomplished using the F430-F Red, Blue, White, or IR LED kits.

A typical example of how to use different color filters or LEDs with monochrome cameras is shown below. The emitted color is matched with the color of the part that needs to be emphasized or de-emphasized, which creates sufficient contrast for the part to be inspected or for the symbol to be decoded. In the example below, the red filter makes the reddish copper look bright, while the green circuit board looks dark. The blue filter produces the opposite effect.

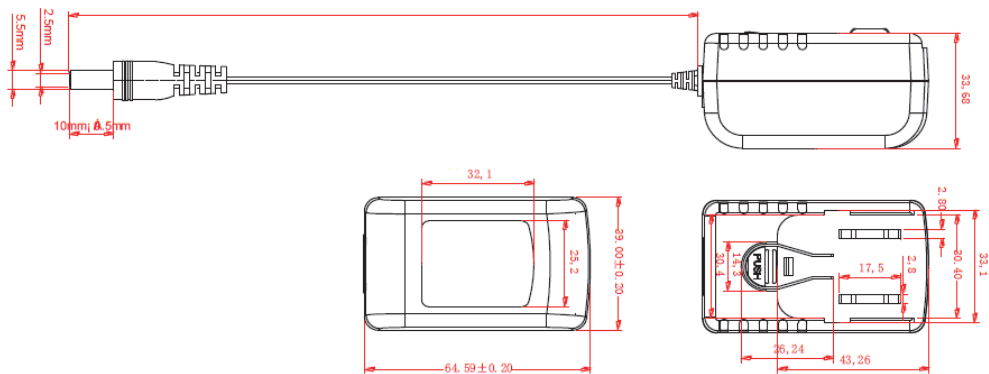
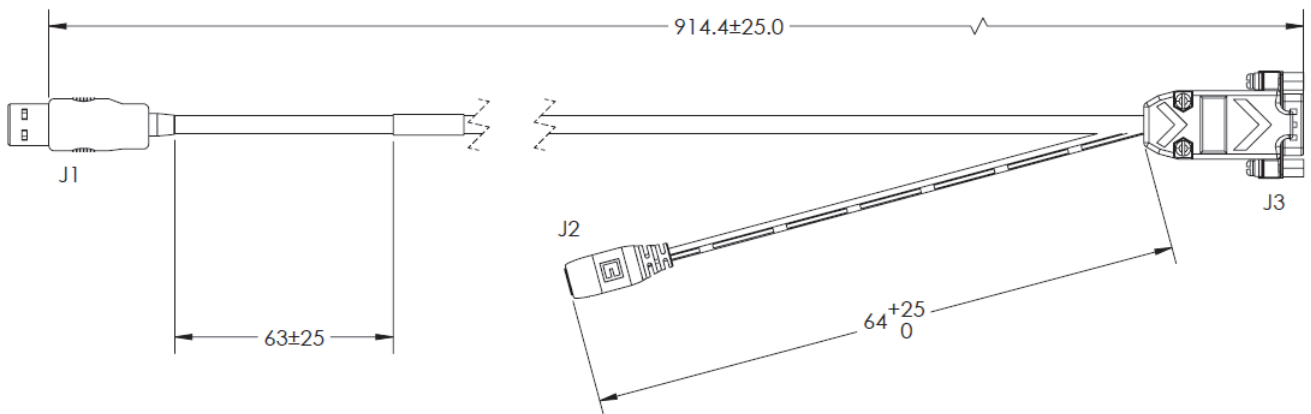
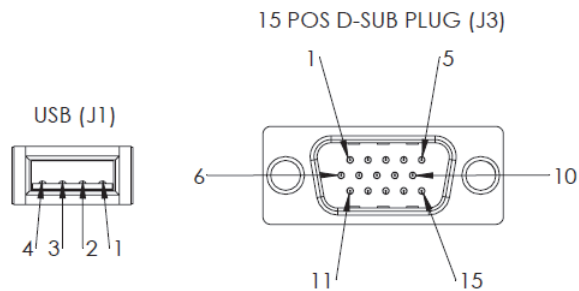
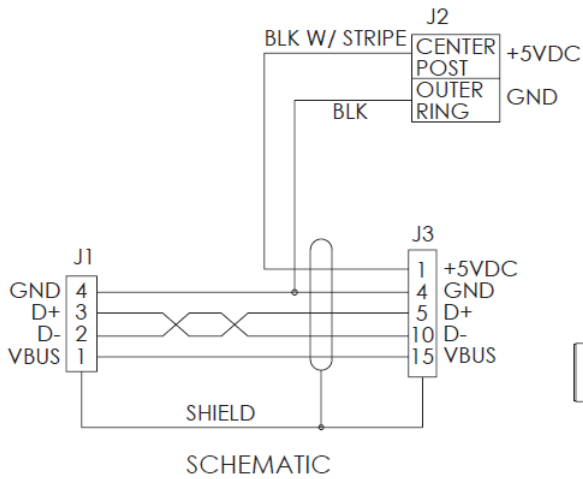
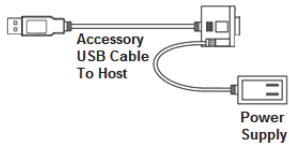


# V420-F

## USB Breakout Cable – 1 Meter V420-WUB-1M

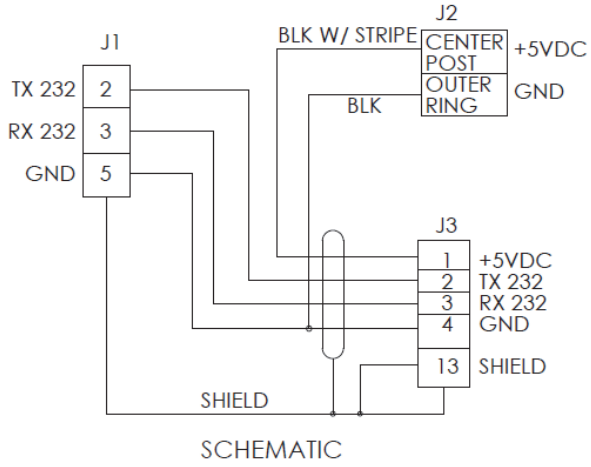
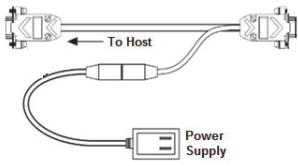


**Kit – USB Breakout Cable with External Power Input (1 Meter) and Power Supply (1 Meter)  
V420-AC1**

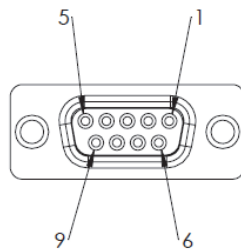


# V420-F

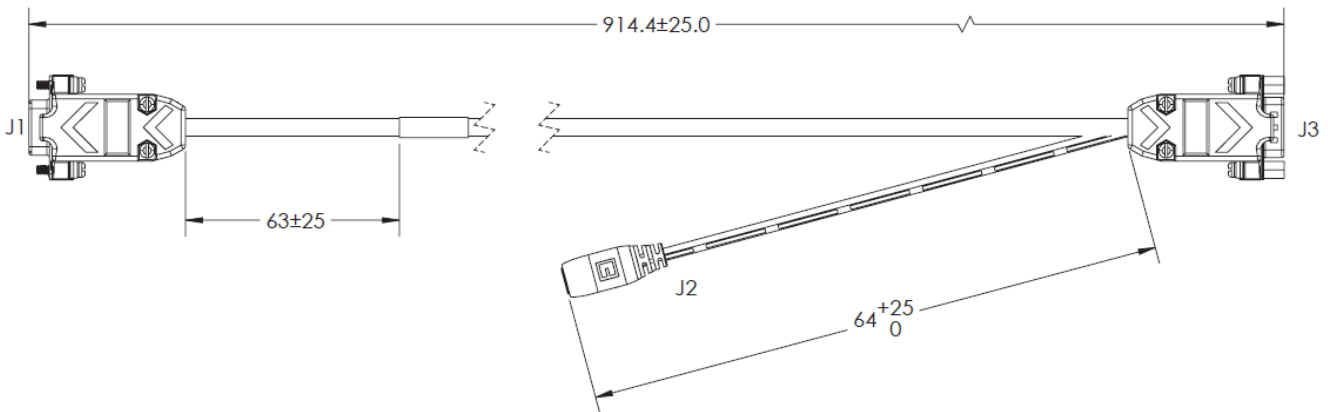
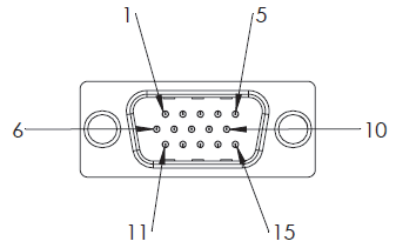
## Kit – RS-232 Breakout Cable (DB-15) with External Power Input (1 Meter) and Power Supply (1 Meter) V420-AC0



9 POS D-SUB SOCKET (J1)

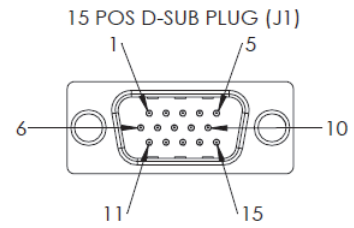
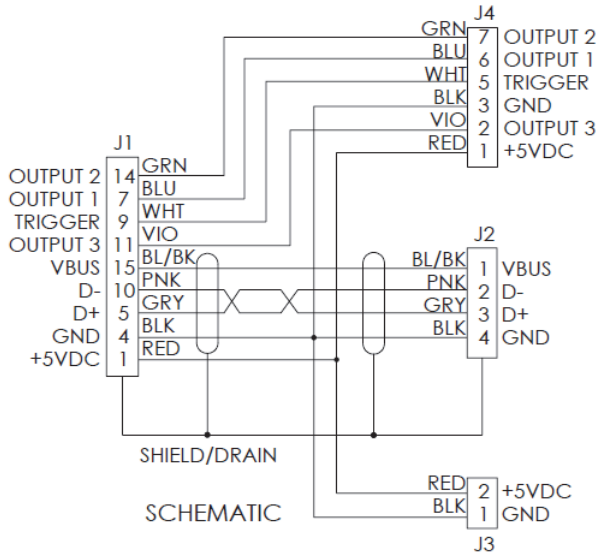
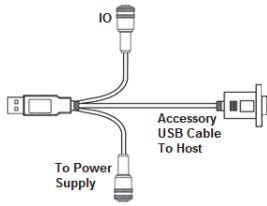


15 POS D-SUB PLUG (J3)

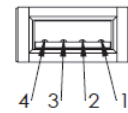




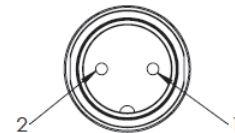
Kit – USB, IO, and Power Breakout Cable (1 Meters) and Power Supply (1 Meter)  
V420-AC2



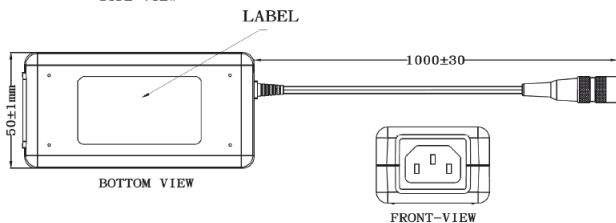
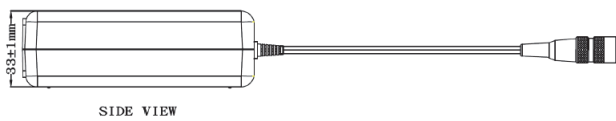
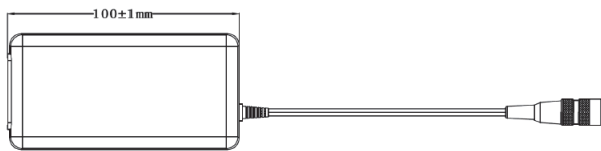
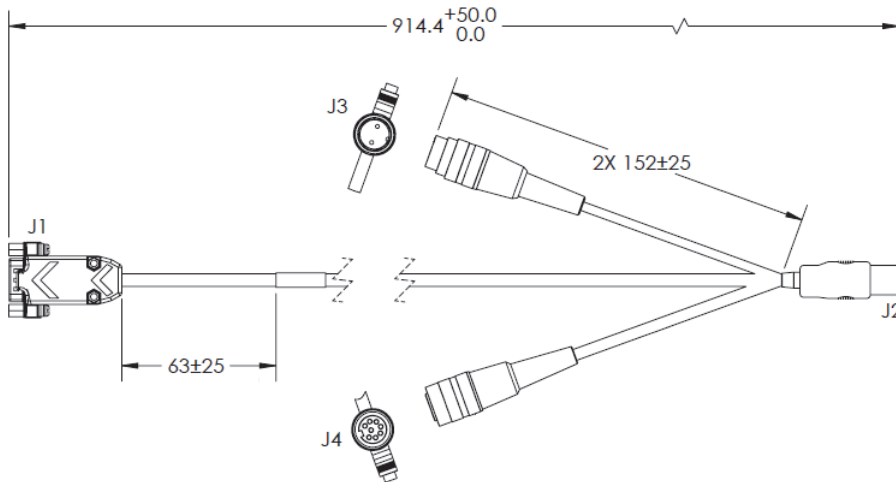
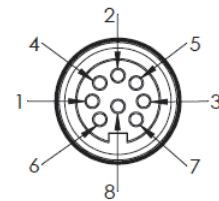
USB (J2)



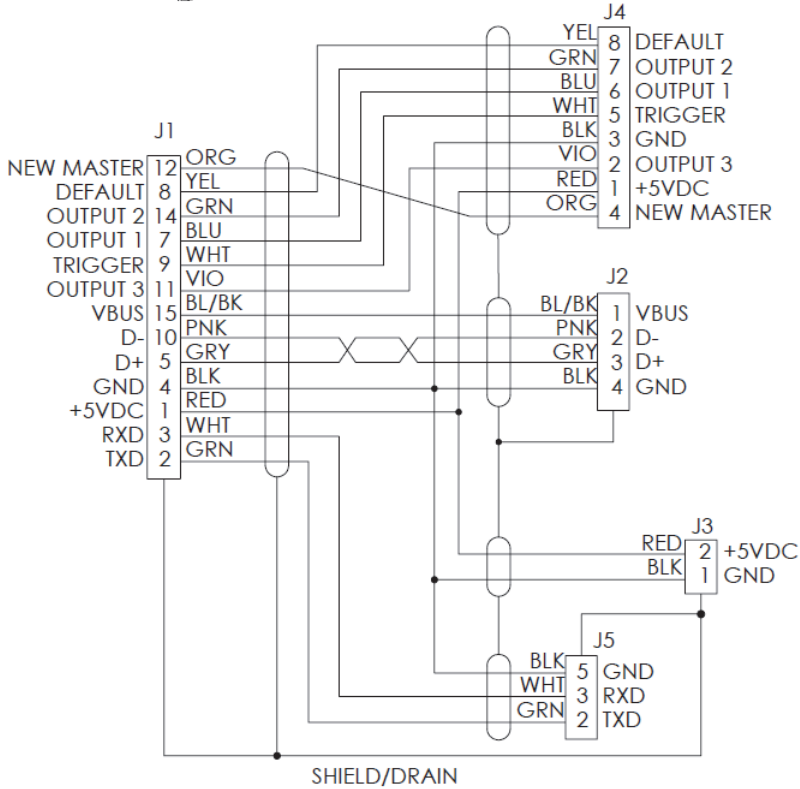
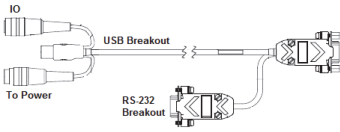
2 POS DIN PLUG (J3)



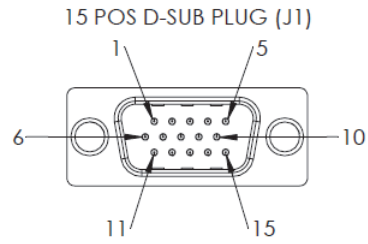
8 POS DIN SOCKET (J4)



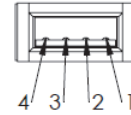
## Cable – RS-232, USB, IO, and Power Breakout – 1 Meter V420-WRU8X-1M



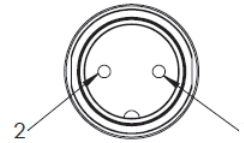
SCHMATIC



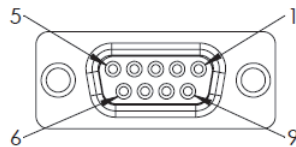
USB (J2)



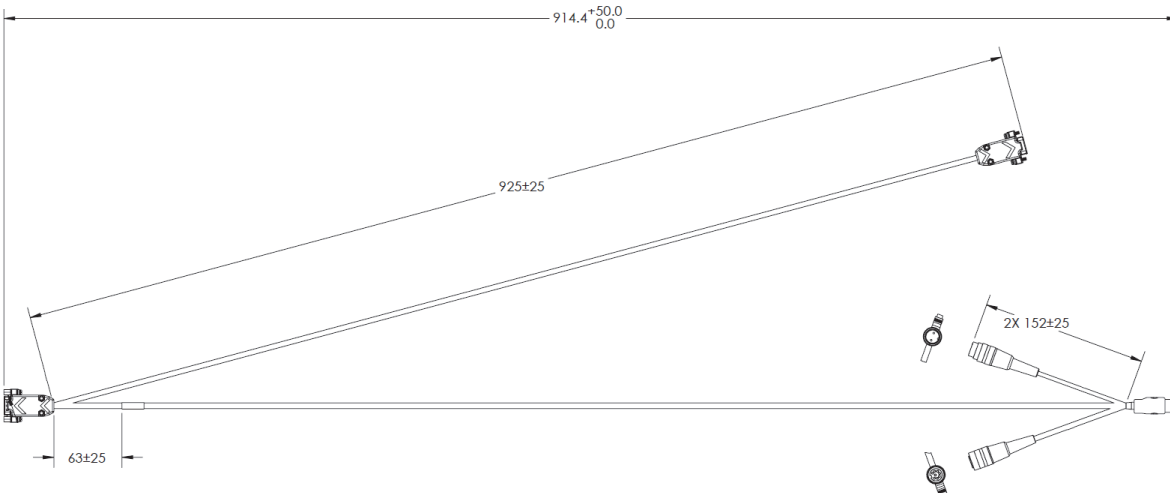
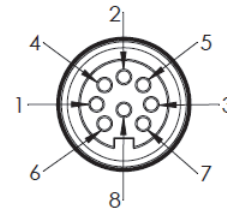
2 POS DIN PLUG (J3)



9 POS D-SUB SOCKET (J5)

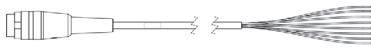


8 POS DIN SOCKET (J4)



**Cable – Trigger, IO, and Power Breakout – 900 MM**  
**61-000151-01**

Plugs into the IO connector on the V420-WU8X-1M and V420-WRU8X-1M cables.

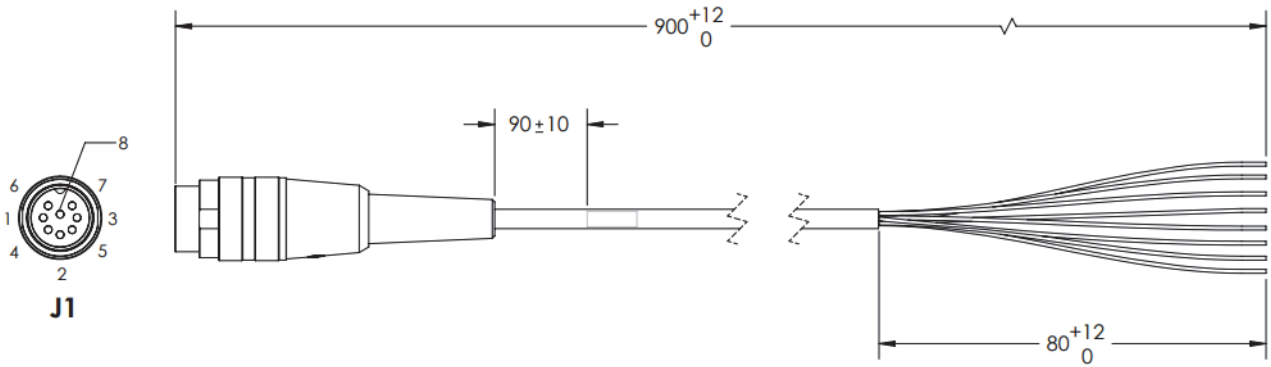


|           |   |        |
|-----------|---|--------|
| +5 VDC    | 1 | RED    |
| OUTPUT 3  | 2 | WHITE  |
| GND       | 3 | BLACK  |
| NEWMASTER | 4 | ORANGE |
| TRIGGER   | 5 | GREEN  |
| OUTPUT 1  | 6 | BLUE   |
| OUTPUT 2  | 7 | BROWN  |
| DEFAULT   | 8 | YELLOW |

**CABLE SPECIFICATIONS**

8 CONDUCTOR STRANDED 22AWG  
 UL LISTED  
 PVC JACKET - BLACK OR GREY

**J1**



**Related Manuals**

| Man. No.             | Model                          | Manual  |
|----------------------|--------------------------------|---|
| Z432 (84-9000400-02) | V320-F, V330-F, V420-F, V430-F | MicroHAWK V320-F / V330-F / V420-F / V430-F User Manual |

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