Introduction

To determine the size of a DPI for an application it is necessary to have data on the load to be supported. The accuracy of the data collected will depend on the technical expertise and measuring instruments that are available on site.

Load parameters

The most accurate result will be obtained when the first three parameters listed are measured on site. The up-time value will depend on the application requirements.It generally falls in the range 0.35 to 3 seconds and is user adjustable from 0.1 to 3.1 seconds in 0.1 second steps. The factory default for this parameter is 1 second.

1. Load voltage (V_{supply})
2. Load current (I_{load})
3. Load power factor ($\cos\Phi$)
4. Up-time (t) Factory default setting 1 second

Methods to determine the electrical parameters

1. Measure the values

The best method to determine the load parameters is to measure them on site. Use a true rms multimeter with a current probe that can measure power factor for the measurements (eg Fluke 39). See Fig 1 for measurement points.

2. Load based estimate

The *continuous* load (VA) or current (A) rating of the devices to be supported should be added together. This information can be found on a schematic diagram of the control circuit in the motor control center (MCC) or switchboard, or from the device manufacturer. Add up the *holding* VA of each contactor *coil* to obtain the total load VA and note the coil/control voltage. The contactor energizing or inrush current need not be considered. Load current is equal to the load VA divided by the load voltage. The load power factor must be estimated. If the load is all contactors and relays use a power factor of 0.2. Check for resistive loads such as PLC power supplies signal lamps or other electronic devices and if these are present use a power factor of 0.75.

3. Control transformer rating

The size of the control transformer(s) can be found on the transformer rating label. Make a note of the VA rating and the secondary voltage (control voltage). The control voltage will normally be 120, 208 or 230Vac. Load current is equal to the transformer VA rating divided by the transformer secondary voltage. The load power factor must be estimated. If the load is all contactors and relays use a power factor of 0.2. Check for resistive loads such as PLC power supplies signal lamps or other electronic devices and if these are present use a power factor of 0.75.

Up-time value

The factory default setting of 1 second will work well with most applications. There are situations where it is necessary to reduce the up-time and others where it is beneficial to increase it. The optimum up-time depends on the application.

1. Low inertia loads require shorter up-times

Large compressors and pumps slow down very rapidly when power is removed and it is considered unsafe to hold the controls in for longer than 350ms. See *Two level*

timer option for more details on compressor and pump applications.

2. High inertia loads use longer up-times

Conveyers and fans are high inertia loads and can run for seconds after the power has been removed. Up-times of 2 to 3 seconds can be used for these applications.

3. Non rotating loads use longer up-times

Boiler and gas oven controls can be held in for longer times and can use up-time settings from 2 to 3 seconds or longer.

Select a DPI based on application data

1. Use the DPI Selector

The easiest and most accurate way to select a DPI is to use the DPI Selector software that is available free of charge from your DPI supplier or download it from our web site. EXCEL must be installed on the computer where the DPI Selector is to be used. Run the DPI Selector and enter the figures for Load current, Load voltage and Load power factor. The up-time for each model is displayed based on the figures entered. Select the model with the up-time closest to the value chosen for the application.

Example:

Application data: t = 1 second / V_{supply} = 120V / I_{load} = 10A / cos Φ = 0.2

Enter these figures in the DPI Selector.

DPI Selector v1.21

Actual Load Current [A]	Actual Input Voltage [Vrms]	Actual Power Factor [cosΦ]	MODEL	Up-time [sec]	Possible choice?	MODEL	Up-time [sec]	Possible choice?
10	120	0.2	DPI52S95J 12	0.31	No	DPI52S25-12	0.16	No
			DPI52S190J 12	0.63	No	DPI52S50-12	0.31	No
Enter the values for 120V models above.			DPI52L238J 12	0.78	No	DPI52L1k12	0.52	No
			DPI52L475J 12	1.57	Yes	DPI52L2k12	1.05	Yes
Load Current Value. Enter the measured load current.			DPI52L713J 12	2.35	Yes	DPI52L3k12	1.57	Yes
			DPI52L950J 12	3.14	Yes			
			DPI52L1188J 12	3.92	Yes			
			DPI52L1663J 12	5.49	Yes			
			DPI52L2376J 12	7.85	Yes			
Enter the values for 230V models below.								
0.43	230	0.8	DPI52S108J 23	1.26	Yes	DPI52S25-23	0.63	Yes
			DPI52S216J 23	2.52	Yes	DPI52S50-23	1.26	Yes
If Power Factor is not known check the load:			DPI52L265J 23	3.09	Yes	DPI52L1k5-23	3.09	Yes
Power supplies, resistors, lamps - cosΦ = 1			DPI52L529J 23	6.18	Yes	DPI52L3k23	6.18	Yes
Contactors &relays only - cosΦ = 0.2			DPI52L794J 23	9.27	Yes	DPI52L4k5-23	9.27	Yes
Mixed loads estimate or use - cosΦ = 0.75			DPI52L1587J 23	18.54	Yes	Notes:		
			DPI52L2381J 23	27.80	Yes	No - Load current exceeds the unit full load rating.		
Measure cosΦ for best accuracy, this is important!			DPI52L3174J 23	37.07	Yes	120 volt models		
Check how cosΦ influences Up- time.			DPI52L3968J 23	46.34	Yes	230 volt models		

Select the DPI52L2K12 with up-time of 1.05 seconds.

2. Use the Minimum up-time formulae

Refer to the *Specifications* section in the user manual, look for the formulae under the heading *Inverter,* sub heading *Minimum up-time as a function of the load*.

Minimum up-time as function of the load: $t = (\eta * C_{cap} * V_{supply}) \div (I_{load} * \cos \Phi)$

Minimum up-time = t	use default (1 sec) or choose a value.
Value of storage capacitor(s) = C_{cap}	see specification for model selected.
Stored energy factor = η	see specification for model selected.
Load voltage = V_{supply}	measure or estimate value.
Load current = I_{load}	measure or estimate value.
Load power factor = cos Φ	measure or estimate value.

Pick a DPI with a VA rating close to the application VA rating then enter the capacitor value and stored energy figures from the DPI specification sheet together with the load data. Compare the Minimum up-time result with the required up-time for the application. If the up-time is too low recalculate using the next largest DPI if the up-time is too large recalculate with the next smaller DPI.

Example

Application data:

t = 1 second / V_{supply} = 120V / I_{load} = 10A / cosΦ = 0.2

Load VA = 1200 try a DPI52L1K12

DPI data from specifications: C_{cap} = 0.022 / η = 0.38

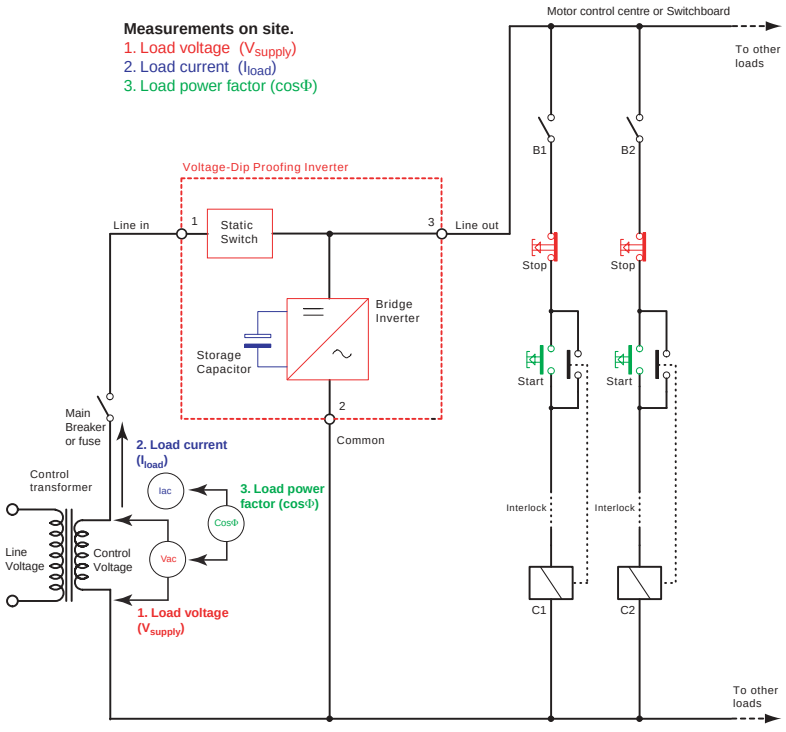
Minimum up-time = (0.38*0.022*120) ÷ (10*0.2) = 0.50 seconds - too low!

Try DPI52L2K12

DPI data from specifications: C_{cap} = 0.044 / h = 0.39

Minimum up-time = (0.39*0.044*120) ÷ (10*0.2) = 1.03 seconds - OK!

Select the DPI52L2K12 for the application.



A typical DPI connection diagram

Fig 1

On site measurement of load parameters