Appendix 2

Appendix2 Table 2. Abnormal POs on workstation Conwip2_6_2 detected by the Aggregated Model of Anomaly Detection

ID PO	$T^{E}_{(1)_{(PO,WS_i)}}$ (h)	$Median\left(T^{E}_{(PO,WS_i)}\right)$ (h)	$T^{E}_{(K)_{(PO,WS_i)}}$ (h)	$T^{R}_{(PO,WS_i)}$ (h)	$E_{(1)_{(PO,WS_i)}}$ (h)	$Median\left(E_{(PO,WS_i)}\right)$ (h)	$E_{(K)_{(PO,WS_i)}}$ (h)	$f(\boldsymbol{IEV}_{(\boldsymbol{PO},\boldsymbol{WS_i})})$
885	74.0	74.0	74.0	71.0	0.04	0.09	0.02	0
453	89.75	67.6	41.1	23.0	0.02	0.07	0.09	0
090	2.5	61.12	69.0	1.0	0.04	0.04	0.1	0
087	47.75	68.5	70.8	5.0	0.03	0.02	0.05	0
317	29.0	67.5	49.9	24.1	0.07	0.07	0.02	0
318	44.75	92.0	51.6	24.1	0.06	0.08	0.09	0
319	116.75	99.5	94.3	4.0	0.05	0.03	0.06	0
320	69.75	71.62	95.9	4.0	0.04	0.0	0.02	0
109	90.25	113.95	116.3	43.0	0.1	0.09	0.02	0
140	19.0	74.9	74.9	68.9	49.9	0.05	0.06	0
142	5.75	168.33	25.9	22.1	16.35	0.07	0.08	0
144	22.75	167.33	43.6	22.1	0.08	0.1	0.06	0
147	69.5	69.5	25.6	24.0	0.03	0.04	0.05	0
150	72.0	171.0	46.9	22.1	0.05	0.02	0.02	0
152	25.25	187.0	48.6	22.1	0.09	0.06	0.09	0
139	2.25	104.5	64.6	17.0	14.75	0.08	0.07	0
149	168.0	52.0	50.3	52.1	0.08	0.1	1.8	0
938	192.0	51.3	51.3	57.0	0.09	5.7	5.7	0
939	1.5	49.0	52.9	57.0	55.5	8.0	4.1	0
946	17.0	47.48	70.6	57.0	40.0	9.52	0.09	0
947	17.75	47.67	72.3	57.0	39.25	9.33	0.07	0
078	51.6	72.4	73.9	57.0	5.4	0.09	0.01	0
145	142.0	167.5	167.0	9.0	0.01	0.02	0.03	0
146	25.5	189.67	174.33	9.0	0.03	0.03	0.04	0
148	70.5	191.0	239.0	9.0	0.06	0.05	0.09	0
153	188.67	188.67	188.67	9.0	0.05	0.02	0.09	0
154	186.67	240.0	240.0	9.0	0.01	0.02	0.08	0
767	1.25	20.0	54.1	51.0	49.75	31.0	0.07	0
141	120.0	125.33	95.4	24.0	0.09	0.08	0.01	0
143	21.5	122.83	88.1	15.0	0.08	0.02	0.04	0
505	2.33	3.67	139.67	2.0	0.08	0.06	0.07	0
507	3.0	28.67	142.33	2.0	0.04	0.0	0.09	0
258	2.33	96.0	172.0	5.0	2.67	0.05	0.05	0
263	93.9	93.9	95.3	100.0	6.1	6.1	4.7	0
227	191.0	144.0	19.9	16.0	0.04	0.07	0.1	0
231	238.67	96.0	42.6	16.0	0.08	0.09	0.06	0
387	20.33	75.0	66.9	16.0	0.04	0.04	0.04	0
372	22.0	72.33	24.9	22.0	0.0	0.06	0.06	0
503	17.0	17.67	115.6	99.0	82.0	81.33	0.01	0

ID PO	$T^{E}_{(1)_{(PO,WS_i)}}$ (h)	$Median\left(T^{E}_{(PO,WS_i)}\right)$ (h)	$T^{E}_{(K)_{(PO,WS_i)}}$ (h)	$T^{R}_{(PO,WS_i)}$ (h)	$E_{(1)_{(PO,WS_i)}}$ (h)	$Median\left(E_{(PO,WS_i)}\right)$ (h)	$E_{(K)_{(PO,WS_i)}}$ (h)	$f(\boldsymbol{IEV}_{(PO,WS_i)})$
504	1.25	17.67	117.3	99.0	97.75	81.33	0.01	1
323	65.0	17.67	114.0	5.0	0.02	0.03	0.02	0
324	1.25	1.67	94.67	5.0	3.75	3.33	0.09	0
321	1.25	19.67	114.0	6.0	4.75	0.08	0.09	0
322	1.25	1.67	94.67	6.0	4.75	4.33	0.05	0
418	139.33	115.6	187.6	175.0	35.67	59.4	0.04	1
421	119.0	98.33	189.3	175.0	56.0	76.67	0.09	0
371	19.67	94.6	359.3	289.0	269.33	194.4	0.07	1
447	18.67	99.3	123.3	95.0	76.33	0.06	0.04	0
492	50.33	100.33	212.67	5.0	0.1	0.0	0.0	0
493	47.67	87.0	211.67	5.0	0.01	0.04	0.05	0
494	141.0	70.67	70.67	5.0	0.06	0.01	0.04	0
267	1.67	22.67	45.9	2.0	0.33	0.04	0.03	0
269	29.0	118.67	403.6	2.0	0.1	0.09	0.07	0
280	48.33	121.33	496.6	2.0	0.09	0.07	0.06	0
264	1.67	1.67	1.67	2.0	0.33	0.33	0.33	0
266	75.33	121.17	2.67	2.0	0.1	0.09	0.03	0
268	165.33	139.0	3.67	2.0	0.02	0.06	0.04	0
270	92.67	82.0	71.33	2.0	0.06	0.06	0.05	0
646	23.67	27.0	97.67	2.2	0.04	0.06	0.08	0
635	173.33	117.5	95.5	22.0	0.03	0.08	0.06	0
650	305.33	305.33	305.33	1.0	0.08	0.08	0.09	0
655	306.33	306.33	306.33	1.0	0.02	0.09	0.07	0
714	239.0	239.0	239.0	1.0	0.05	0.0	0.0	0
719	240.0	240.0	240.0	1.0	0.01	0.01	0.07	0
720	31.0	190.33	240.67	1.0	0.05	0.07	0.06	0
653	257.67	93.3	135.9	66.0	0.02	0.08	0.03	0
656	23.67	112.6	161.3	66.0	42.33	0.09	0.08	0
657	311.67	114.3	138.3	66.0	0.05	0.03	0.04	0
717	332.33	115.9	139.3	66.0	0.08	0.04	0.08	0
721	355.0	135.3	142.6	66.0	0.05	0.09	0.09	0
725	218.67	218.67	46.6	5.0	0.1	0.07	0.09	0
730	30.0	95.67	50.6	22.0	0.05	0.08	0.04	0
731	76.67	77.0	52.3	22.0	0.03	0.04	0.05	0
580	168.67	152.83	121.0	1.0	0.03	0.03	0.05	0
757	124.33	96.67	96.67	4.0	0.02	0.04	0.08	0
758	97.67	97.67	97.67	4.0	0.07	0.08	0.09	0
326	187.33	68.5	123.0	1.0	0.07	0.07	0.1	0
328	188.33	70.0	124.0	22.0	0.0	0.0	0.01	0
722	29.67	151.0	165.3	173.0	143.33	22.0	7.7	1
726	67.0	145.33	166.9	173.0	106.0	27.67	6.1	0
728	52.0	156.17	168.6	173.0	121.0	16.83	4.4	0

ID PO	$T^{E}_{(1)_{(PO,WS_i)}}$ (h)	$Median\left(T^{E}_{(PO,WS_i)}\right)$ (h)	$T^{E}_{(K)_{(PO,WS_i)}}$ (h)	$T^{R}_{(PO,WS_i)}$ (h)	$E_{(1)_{(PO,WS_i)}}$ (h)	$Median\left(E_{(PO,WS_i)}\right)$ (h)	$E_{(K)_{(PO,WS_i)}}$ (h)	$f(\boldsymbol{IEV}_{(PO,WS_i)})$
761	265.33	119.33	66.0	4.0	0.02	0.02	0.02	0
763	24.67	24.67	73.0	2.0	0.01	0.04	0.08	0
784	119.67	96.33	91.33	6.0	0.1	0.02	0.02	0
785	124.67	24.0	1.67	4.0	0.05	0.03	2.33	0
787	215.33	21.67	5.33	2.0	0.07	0.1	0.03	0
788	234.0	24.67	70.33	2.0	0.08	0.0	0.09	0
789	236.67	24.83	72.0	2.0	0.01	0.01	0.01	0
Mean Error (h)					**15.07**	**7.28**	**0.47**	

Appendix2 Table 3. Error Values, model's normalized scores, normalized Entropy and anomalies for the Test_Data of the workstation Conwip2_8_6

PO Number	First Error (h)	Median Error (h)	Last Error (h)	AE Score	SVM Score	IF Score	Entropy	Is Abnormal
1	1369	817.2	0.08	0.74	0.99	1.0	0.99	0
2	6.00	0.05	0.05	0.64	0.77	0.0	0.62	0
3	1447	874.80	0.08	1	1	1	1	1
4	193.7	166.0	0.03	0	0	0.06	0	0

Appendix2 Table 4. Error Values, model's normalized scores and normalized Entropy for the Train_Data of the workstation Conwip2_8_6

PO Number	First Error (h)	Median Error (h)	Last Error (h)	AE Score	SVM Score	IF Score	Entropy
1	334.7	213.3	0.05	0.33	1	0.07	0.67
2	725.7	695.3	0.03	1	0.37	1	0.92
3	359.1	192.7	0.04	0	0	0	0
4	450.2	295.8	0.02	0	1	0.61	0.6
$\boldsymbol{Percentile}_{90}$				**0.79**	**1**	**0.88**	**0.85**

Appendix2 Table 5. Error Values, model's normalized scores and normalized Entropy for the Train_Data of the workstation Conwip2_11_3

PO Number	First Error (h)	Median Error (h)	Last Error (h)	AE Score	SVM Score	IF Score	Entropy
257714	23.2	3.4	3.4	0.01	0.7	0.05	0.29
257720	22.7	3.4	3.4	0.01	0.7	0.05	0.28
257715	3.4	3.4	3.4	0.01	0.81	0.0	0.08
257717	2.9	2.9	1.6	0.01	0.88	0.01	0.12
257721	3.4	3.4	3.4	0.01	0.81	0.0	0.08
257723	3.9	2.4	0.9	0.01	0.92	0.03	0.19
257262	28.3	7.6	4.3	0.01	0.58	0.09	0.41
257263	4.9	4.9	4.9	0.01	0.74	0.04	0.23
257729	2.5	2.5	2.5	0.01	0.86	0.01	0.12
257735	26.7	6.5	3.2	0.01	0.62	0.08	0.37
257897	1.9	1.9	1.9	0.01	0.9	0.03	0.2
257898	4.9	3.55	2.2	0.01	0.83	0.01	0.12
257713	1.8	1.8	1.8	0.01	0.91	0.04	0.2
257719	20.5	20.5	1.4	0.0	0.48	0.02	0.21
257722	0.03	0.06	4.7	0.01	0.88	0.24	0.51
257137	0.07	4.25	4.2	0.01	0.8	0.08	0.32
257192	5.6	5.6	3.5	0.01	0.74	0.03	0.19
257257	21.25	21.25	0.9	0.0	0.49	0.05	0.31
257453	25.25	25.5	4.9	0.0	0.29	0.08	0.5
257193	23.15	23.4	3.6	0.0	0.34	0.03	0.26
257258	7.25	7.5	0.08	0.01	0.85	0.08	0.32
257259	0.0	7.5	1.4	0.01	0.83	0.1	0.35
257260	20.25	20.38	3.4	0.0	0.4	0.02	0.19
257725	5.75	9.25	1.4	0.01	0.75	0.05	0.27
257726	23.25	23.5	3.4	0.0	0.34	0.03	0.26
257731	24.25	24.5	3.9	0.0	0.32	0.03	0.3
257732	47.25	46.5	5.4	0.0	0.02	0.2	0.3
257895	32.25	32.5	4.4	0.0	0.18	0.1	0.6
257261	32.25	32.5	3.2	0.0	0.2	0.08	0.57
257264	49.25	49.25	5.2	0.0	0.0	0.16	0.06
257727	32.25	32.5	2.9	0.0	0.21	0.09	0.58
257728	49.25	49.25	4.9	0.0	0.0	0.16	0.0
257733	99.4	72.05	1.6	0.01	0.09	0.46	0.46
257734	32.5	32.33	10.1	0.0	0.34	0.27	0.65

PO Number	First Error (h)	Median Error (h)	Last Error (h)	AE Score	SVM Score	IF Score	Entropy
258108	571.33	272.8	7.4	0.17	1.0	0.96	0.83
258109	0.01	2.33	2.33	0.01	0.89	0.07	0.29
257938	609.25	393.7	8.1	0.36	0.94	0.91	0.93
257939	628.33	394.4	8.1	0.36	1.0	0.79	0.93
258142	628.5	394.4	8.1	0.36	1.0	0.79	0.93
258149	4.25	4.33	5.4	0.01	0.76	0.07	0.3
258150	5.25	5.33	5.7	0.01	0.73	0.09	0.36
258143	8.25	8.33	3.1	0.01	0.68	0.05	0.27
258152	7.25	7.33	2.1	0.01	0.75	0.03	0.18
258144	26.25	26.33	3.4	0.0	0.29	0.05	0.4
258151	36.5	100.33	5.4	0.01	0.42	0.43	0.69
258147	22.33	22.33	2.1	0.0	0.41	0.05	0.33
258148	21.33	21.33	1.4	0.0	0.46	0.03	0.23
258153	49.25	49.33	2.1	0.0	0.04	0.16	0.49
258154	45.33	45.33	2.1	0.0	0.08	0.17	0.58
258139	17.33	17.33	1.7	0.0	0.53	0.05	0.32
258140	48.33	48.33	2.1	0.0	0.05	0.15	0.53
258145	28.33	28.33	3.7	0.0	0.25	0.08	0.52
258141	39.33	39.33	0.04	0.0	0.25	0.22	0.65
258078	39.33	39.33	0.09	0.0	0.25	0.22	0.65
258258	2.33	2.33	0.33	0.01	0.97	0.05	0.23
257980	2.33	2.33	1.0	0.01	0.93	0.03	0.18
257981	96.33	96.33	0.09	0.01	0.22	0.47	0.62
258227	9.33	9.33	0.08	0.01	0.81	0.12	0.39
258231	138.33	137.67	0.1	0.03	0.98	0.53	0.66
258387	101.33	98.83	1.1	0.01	0.21	0.44	0.63
258426	138.33	138.33	0.01	0.03	1.0	0.55	0.66
258371	16.23	16.23	0.03	0.01	0.65	0.11	0.42
258418	23.33	23.33	2.1	0.0	0.39	0.05	0.36
258493	4.33	4.33	0.4	0.01	0.91	0.06	0.26
258447	2.33	2.17	0.01	0.01	1.0	0.09	0.31
258492	2.33	2.33	0.0	0.01	0.99	0.08	0.29
258494	3.2	3.03	3.03	0.01	0.82	0.0	0.05
257454	137.6	137.1	4.8	0.02	0.99	0.64	0.67
257455	46.43	46.43	46.43	0.12	1.0	0.62	0.8

PO Number	First Error (h)	Median Error (h)	Last Error (h)	AE Score	SVM Score	IF Score	Entropy
257321	8.33	8.33	8.33	0.01	0.71	0.21	0.52
257884	57.33	57.33	57.33	0.2	1.0	0.71	0.86
258328	118.43	118.43	118.43	1.0	1.0	1.0	1.0
258661	14.33	14.33	14.33	0.01	0.94	0.35	0.57
258757	15.33	15.33	15.33	0.01	1.0	0.38	0.57
258763	1.33	1.33	1.33	0.01	0.94	0.07	0.29
Percentile$_{90}$				0.02	0.99	0.60	0.68

Appendix2 Table 6. Error Values, model's normalized scores and normalized Entropy for the Test_Data of the workstation Conwip2_11_3

PO Number	First Error (h)	Median Error (h)	Last Error (h)	AE Score	SVM Score	IF Score	Entropy	Is Abnormal
258720	70.3	70.33	0.02	0.0	0.01	0.42	0.11	0
258715	9.33	9.33	0.09	0.0	0.11	0.1	0.69	0
258717	22.3	22.33	0.0	0.0	0.07	0.1	0.66	0
258659	8.33	8.33	8.33	0.0	0.1	0.18	0.62	0
258657	104.33	104.33	3.1	0.0	0.03	0.43	0.27	0
258658	182.1	150.0	171.33	0.87	0.99	0.94	1.0	1
258731	51.33	51.33	2.7	0.0	0.0	0.16	0.0	0
258653	22.33	22.33	0.08	0.0	0.07	0.09	0.66	0
258280	139.33	139.33	1.4	0.01	0.14	0.52	0.53	0
258726	0.33	0.33	0.33	0.0	0.14	0.18	0.68	0
258270	0.33	0.0	0.09	0.0	0.14	0.21	0.67	0
258655	16.33	16.33	0.07	0.0	0.09	0.08	0.68	0
258660	8.33	8.33	8.33	0.0	0.1	0.18	0.62	0
258725	296.33	250.0	174.4	1.0	1.0	1.0	1.0	1
258714	27.33	27.33	1.4	0.0	0.05	0.09	0.61	0
258580	45.33	45.33	45.33	0.05	0.14	0.59	0.63	0
258267	128.33	128.33	0.05	0.01	0.1	0.52	0.46	0

PO Number	First Error (h)	Median Error (h)	Last Error (h)	AE Score	SVM Score	IF Score	Entropy	Is Abnormal
258264	112.33	128.0	1.4	0.01	0.09	0.49	0.44	0
258268	139.33	139.33	2.1	0.01	0.13	0.52	0.52	0
258263	18.33	18.33	0.04	0.0	0.08	0.09	0.67	0
258728	4.33	4.33	4.33	0.0	0.1	0.0	0.11	0
258266	139.33	139.33	2.7	0.01	0.14	0.53	0.52	0
258651	9.33	9.33	0.06	0.0	0.11	0.1	0.69	0
258721	104.33	104.33	2.7	0.0	0.03	0.43	0.27	0
258565	3.33	3.33	0.33	0.0	0.13	0.03	0.51	0
258656	4.33	4.33	0.09	0.0	0.13	0.06	0.65	0
258650	24.33	24.33	0.09	0.0	0.06	0.09	0.65	0
258722	0.02	3.33	3.33	0.0	0.11	0.04	0.62	0